AP42 Section: 13.2.1 Paved Roads

Title: Establish Silt Loading Database for Typical Roads for use in AP-42 Section 13.2.1

Paved Roads

EPA Contract 68-D3-0001

November 1997

Not a reference

Note: This material is related to a section in *AP42, Compilation of Air Pollutant Emission Factors, Volume I Stationary Point and Area Sources.* AP42 is located on the EPA web site at www.epa.gov/ttn/chief/ap42/

The file name refers to the file number, the AP42 chapter and then the section. The file name "rel01_c01s02.pdf" would mean the file relates to AP42 chapter 1 section 2. The document may be out of date and related to a previous version of the section. The document has been saved for archival and historical purposes. The primary source should always be checked. If current related information is available, it will be posted on the AP42 webpage with the current version of the section.

FINAL PROJECT REPORT

ESTABLISH SILT LOADING DATABASE FOR TYPICAL ROADS FOR USE IN AP-42 SECTION 13.2.1, PAVED ROADS

EPA Contract No. 68D30001
Work Assignment No. 4-01
PES Project No. I401

Prepared for

Mr. Ron Myers
Emission Factors and Inventory Group
Emissions Monitoring and Analysis Division
U.S. Environmental Protection Agency
Research Triangle Park, NC 27711

November 10, 1997
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Submitted by

PACIFIC ENVIRONMENTAL SERVICES, INC.
5001 S. Miami Blvd., Suite 300
PO Box 12077
Research Triangle Park, NC 27709-2077
(919) 941-0333, FAX (919) 941-0234

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INTRODUCTION

The current national inventory for particulate matter with an aerodynamic diameter less than 10 μm (PM-10) indicates that paved road emissions account for over 27 percent of the national emissions of PM-10. The basis of this inventory uses the emission factor presented in Section 13.2.1 of *Compilation of Air Pollutant Emission Factors, Volume I: Stationary Point and Area Sources*, Fifth Edition, January 1995, including Supplement A (AP-42) with a modification of the median silt loading presented for paved roads. There is evidence to suggest that the national inventory overestimates the true emissions significantly. It is believed that part of this overestimation is caused by the silt loadings used to make the national estimate. It is known that the silt loading database presented in the paved roads section of AP-42 is biased as a result of sampling from limited localities in the western US and sampling following events which would result in increased silt loading to the roadway. The Environmental Protection Agency (EPA) is currently reviewing the national ambient air quality standard for particulate matter and may revise the standard to include finer fractions than 10 μm. Should the Agency select a finer size cutoff, it is estimated that paved road emissions will decrease to 16 percent of national emissions; however, this estimate conflicts with the evidence available from ambient samples suggesting that the percentage should be much less than 16 percent. The Agency would like to obtain silt loading data more representative of the types of paved roadways contributing to the national particulate emissions and would like to begin the collection of information which would identify key roadway design, operation, and usage characteristics that affect silt loading. If possible, the Agency would like to foster an interest by State and local agencies to initiate a more thorough collection of silt loading information for use in local and regional inventories and for use in conformity analyses during roadway planning.

This final report format lists each task assignment, followed by a discussion of how the task was performed and the results. In some cases, recommendations follow the discussion of task results to clarify issues and to present suggestions for future task assignments, based on experience from following this work assignment.

WORK ASSIGNMENT TASK 1

The contractor shall identify and obtain information in the National Emissions Trends database which breaks out emissions of fugitive particulate emissions from paved roads by road classification and Metropolitan Area. The contractor shall establish a methodology to prioritize the matrix of road type and metropolitan area for collection of road surface silt samples. The contractor shall contact individuals in the EPA Regions and the State or Local Air Pollution Control Agencies which are responsible for mobile source emission estimates in the highest priority metropolitan areas to further refine the priority list. The contractor shall

identify those metropolitan areas where local assistance can be obtained for an initial collection of the paved road samples to characterize the silt loading. In addition, the contractor shall identify those metropolitan areas which are willing to perform silt loading analysis on additional roads and during other seasons of the year than the initial collection time.

National Emission Trends Database

PES contacted E. H. Pechan & Associates, of Springfield, VA, to request a copy of the National Emissions Trends database. EPA's Sharon Nizich authorized the release of a diskette copy of the National Emissions Trends database to PES.

The diskette contains 11 silt loading database files, one for each year -- 1984 through 1994. The silt loading files are named PMSILT*yy*.dbf where *yy* is the year of the data (i.e., 84, 85, ..., 94). Each PMSILT database file contains silt loading data from paved roads for all 50 states and the District of Columbia in grams/square meter (g/m^2) for both urban and rural roadways. The databases are further subdivided by roadway type; freeway, major street, collector, or local roadway.

In addition to the silt loading databases, the diskette also contains 11 corresponding rain data files. The rain data files are named RN*yy*_PVD.dbf, where *yy* is the year of the data. Each RN*yy*_PVD.dbf database file contains the total number of rain days experienced by month for every State and the District of Columbia.

PES analyzed the 1994 silt loading data using the geographical information system Mapinfo©. Eight maps were generated, one for each road type under both urban and rural classifications. Each map shows a graphical representation of the United States where every state is color coded to correspond with its relative amount of silt loading. See Appendix A.

The maps clearly illustrate that the most heavily silt loaded roads exist in North Dakota, South Dakota, Wyoming, and Montana, with the rest of the states being lower. This confirms the suspicion that the national inventory may overestimate fugitive emissions from paved roads due to the use of emission factors that are based on roadway silt loading data from these western states. This analysis indicates a need to establish a larger national data base for road silt loading, representing more of the United States.

PES contacted EPA Regional, State, and local offices in an attempt to get input concerning the identity of road segments for priority sampling of surface silt loading. The results from this effort are shown in Appendix B. It appears the priorities that have been established at both the Regional and State offices are consuming all their attention and assets. There is little interest in the development of a list of road types and metropolitan areas for the collection of road silt data. PES, working with the WAM, determined that four-lane highways

where posted traffic speeds range between 35 and 55 miles per hour are the priority road type.

WORK ASSIGNMENT TASK 2

The contractor shall coordinate with EPA Regional, State, and local contacts in the highest priority metropolitan areas to identify road segments representative of the highest priority design and use characteristics to be selected for initial sampling for surface silt loading. The contractor shall coordinate with other Regions and municipalities which are willing to perform additional sampling so that valid information is obtained and may be incorporated in the study.

PES attempted to identify agencies willing to perform silt loading sample collections from key road types. Although there was some interest, the Regions and States are generally unable at this time to commit their limited assets toward this project. EPA Region 2, West Virginia and Michigan State agencies, have expressed some interest in our study. No organization would volunteer to gather road silt samples initially, or later during the different seasons.

WORK ASSIGNMENT TASK 3

The contractor shall coordinate with the study participants and others knowledgeable in paved road silt deposition and removal to identify key characteristics (such as road design, traffic type and volume, road maintenance and meteorological events) which may result in variations of the silt content of the roads.

PES contacted experts knowledgeable in paved road silt deposition and removal. With assistance from the experts such as Gregory E. Muleski, Principal Environmental Engineer with Midwest Research Institute (MRI) of Kansas City, Missouri, and Chat Cowherd of MRI, PES is able to identify key characteristics which affect silt content on roads.

Mr. Muleski believes that traffic speed is the major determinant effecting silt loading values. Traffic speed is followed by road winter maintenance such as sanding and salting the road bed for traction. Road design, the presence of curbs and gutters, is the next important factor that effects silt loading.

Chat Cowherd discussed the relationships of traffic volume, traffic speed, road maintenance, threshold speed of wind erosion, land use, and road design to the relative of amount of silt loading found on paved roads. He pointed out that there is an inverse relationship between the amount of traffic and silt loading. The higher the traffic volume, the

lower amount of silt loading. The inverse relationship also is true for light traffic volumes. The lighter the traffic volume, the higher the silt loading.

Traffic volume has a direct relationship with traffic speed. Similar roads handling higher traffic volumes tend to have higher posted speed limits. The higher the traffic volume on similar roads, the higher the speed limit, and the lower the silt loading. This direct relationship of traffic volume to traffic speed, and the inverse relationship of high traffic speed with low silt loading has been substantiated empirically with the silt loading samples collected by PES. Inversely, roads with low amounts of traffic and low speeds show high silt loadings. Traffic volume is defined as high if there are more than 5000 vehicle passes in a day. High speed roads are defined as having posted speed limits above 35 miles per hour.

Low wind velocity may not be a major consideration for silt loading influence. It was thought that wind erosion of near by unpaved surfaces can alter loading levels. The wind velocity necessary to erode soil and other matter and deposit it onto roadbeds is 13 miles per hour. However, soil type and particle size may influence road silt loading.

Land use contributes to road silt loading. Road silt loading levels tend to be higher on roadways that pass through industrial areas. This higher loading is due to industrial areas that have unpaved sections where the vehicles can pick up soil, gravel, and residuals from spilled loads, and then drop these materials onto the roads. This action is called "track out." Roads in residential areas show lower loading levels than some roads that pass through industrial areas.

WORK ASSIGNMENT TASK 4

The contractor shall review Appendix C.1 and C.2 of AP-42. The contractor shall prepare a Quality Assurance (QA) plan to establish the comparability of the Mobile Silt Collection System for Paved Roads to the procedures described in Appendix C.1 of AP-42. Information to be included in the QA plan are methods to establish the precision and accuracy of the alternative collection method compared to the established method. The QA plan shall include decision points for the performance of split samples. The QA plan shall be presented to the WAM for approval. Considering the existing sampling and analysis procedures for paved road surface silt analysis and the forms depicted, the contractor shall design a replacement form for this study which includes QA procedures approved by the WAM and for documenting key road design and use characteristics that should be collected for all roads. In addition, the contractor shall design an optional portion of the form which can be used for documenting other characteristics which are believed to be important but would require a larger database to identify relationships between them and the surface silt loading of the roads.

PES has reviewed Appendix C.1 And C.2 of AP-42. The current status of a mobile collection system will be discussed in more detail under work assignment 6. The mobile system was designed, and a road test of a simulation sample collection system was conducted to empirically test the efficiency of the vacuum pick-up nozzle, and to compare the results with samples collected manually. The road tests demonstrated that the mobil road silt vacuum nozzle could not collect equivalent samples as those collected using the AP-42 manual road silt collection procedures.

PES was directed to collect road silt samples manually while attempting to solve the mobile road silt collection problem. As planning and preparations for manually collecting road silt samples began, PES recognized that additional procedures had to be developed and formalized in addition to those discussed in Appendix C.1.2 and C.2.2. To minimize variables during sample collection, and to provide safety during the collection process, PES developed written quality assurance procedures for the preparation and handling of vacuum cleaner sample bags, and procedures to follow for protecting the collection crew during the collection process.

Laboratory procedures, described in Appendix C.2, AP-42, were reviewed for quality assurance and combined with additional steps and check points. The sampling data for paved roads form, Figure C.1-4, the moisture analysis form, Figure C.2-3, and the silt analysis form, Figure C.2-4, were combined and enhanced in an Excel™ workbook. This workbook has paste functions, equation calculations, and quality assurance points. Information entered in the data collection sheet is automatically copied and pasted in the moisture analysis section and the silt analysis section of the second page in the workbook. The area measurements are reported as two linear foot measurements. The workbook calculates and sums the sample areas, converts the square foot units to square meter areas, and pastes those numbers on the second sheet for additional calculations. A part of the quality assurance checks compares the net dry sample weight calculated during moisture analysis to the total sample weight after the silt analysis. Two percent difference in mass has been chosen as a reasonable limit. The workbook performs a uniquely calculated value in grams for each sample.

These changes and enhancement are discussed in the Quality Assurance manual in Appendix C. The Quality Assuance manual follows the guidelines given in "Preparation Aids for the Development of Category II Quality Assurance Project Plans," EPA/600/8-91/004. As required by that document, the QAPjP briefly discusses overall project objectives and the data required to meet those objectives. The QAPjP also addresses QA issues related to data reduction, validation, and reporting. The QAPjP describes the necessary sampling and analysis quality assurance procedures for the manual system. PES revised the existing forms given in Appendices C.1 and C.2 of AP-42 to satisfy many of these requirements, to document key road design and use characteristics, and to document other important characteristics which may impact silt loadings.

WORK ASSIGNMENT TASK 5

The contractor shall coordinate/set up and perform training sessions with selected State/local agencies to educate the participants on the proper sample collection and analysis methods, QA procedures, documentation requirements, and procedures for the sharing of the information obtained.

The execution of Task 2 resulted in a finding that local assistance in metropolitan areas is not available for the collection of paved road samples to characterize the silt loading in other parts of the country. This finding eliminated the need to train State and local agency personnel. PES coordinated and conduct training sessions for the PES personnel, who operated the manual road silt collection system equipment, on the proper sample collection and analysis methods, QA procedures, and documentation requirements. This training included follow-up quality assurance observation of actual collecting and analyzing operations at various stages during the period of effort.

WORK ASSIGNMENT TASK 6

The contractor shall arrange for the collection of road surface silt samples, the collection of the road design and use characteristics, the analysis of the samples collected, and the compilation of the information obtained. The contractor shall facilitate the sharing of the data among participants of the study.

PES collected and analyzed road surface silt samples, using revised sample data and analysis forms generated during this work assignment that reflect road design and use characteristics. As originally contemplated, State and local agencies would be assisting in the sample collection effort in several regions of the country. That assistance was not available.

The contractor shall design, construct and evaluate a Mobile Silt Collection System for Paved Roads such that samples collected with this system comply with the Federal Guidance for EPA for a "Moving Operational Caravan." The contractor shall use the Mobile Collection System for Paved Roads to collect samples at sites representative of those believed to be the major contributors of the paved road emissions as indicated in the National Emissions Trends database.

PES designed a Mobile Silt Collection System for Paved Roads. This system is designed to collect road silt at linear speeds that meet or exceed the minimum requirements of the Federal Guidance for a "Moving Operational Caravan." PES conducted road tests with a simulated mobile road silt vacuum system simultaneously with manually collecting samples

from the same road conditions. The specific procedures used and the analyzed results from the study are covered in the test report document in Appendix D. The mobile vacuum nozzle was not efficient enough to overcome the linear velocity of 3.5 to 4 miles per hour over-the-ground. The manually collected samples exceeded the mass collected using the mobile road silt collection system.

A new nozzle system was assembled that incorporated compressed air. Eight brass fan style nozzles were mounted at a 45 degree angle to the roadbed. Compressed air washes the road surface, directing particulate toward the vacuum cleaner nozzle suction. A test was devised in the PES laboratory to find out if the efficiency of the vacuum cleaner nozzle is increased through the use of compressed air that increase particle momentum toward the low pressure area of the system. A five foot long distance on the floor of the lab was marked off. A sample of 300 grams of construction sand was spread over the five foot length about 8 inches wide. The vacuum nozzle was pulled across this area over a period of 1 second to simulate the over the ground speed of 3 to 4 miles per hour. The results can be seen in Table 1.

TABLE 1. MEASURING NOZZLE EFFICIENCY COMPARISON

Trial Number	Sample Mass (gms)	Material Not Collected (gms)	Mass Vacuumed (gms)
1 (Vacuum Only)	300 (new sand)	285	15
2 (Vacuum Only)	300	284	16
3 (Compressed Air)	300	254	46
4 (Compressed Air)	300	260	40
5 (Compressed Air)	300	270	30
6 (Compressed Air)	300 (new sand)	272	28
7 (Vacuum Only)	300	288	12
8 (Vacuum Only)	300	288	12
9 (Compressed Air)	300	271	29
10 (Compressed Air)	300	271	29

Material collected using the vacuum cleaner suction only averaged 13.8 grams while the combined vacuum suction and compressed air averaged 26 grams. These two numbers indicate that the efficiency of a vacuum cleaner nozzle, moving across a surface at 3 to 4 miles per hour, can be improved nearly 100 percent by combining compressed air flow with a vacuum suction. The mobile road silt collection road tests, performed earlier, demonstrates that the vacuum cleaner nozzle efficiency was not sufficient to collect road silt samples comparable to those collected manually.

This experiment does not demonstrate that a mobile road silt collection system is feasible, but it does answer the nozzle efficiency question. Please note that the sample density in this experiment was 90 grams per square foot, a number many times the average road sample density. PES believes a lighter density sample will favor the combined vacuum and compressed air combination. Additionally, the compressor used in the laboratory was limited in pumping capacity and compressed air storage. Only 40 psi could be maintained at the high pressure hose consistently for a period of time to accurately run the experiments. At 40 psi, sand placed completely around the vacuum cleaner nozzle was pulled into the vacuum, showing that the compressed air was not overwhelming the movement of air entering the vacuum cleaner. This indicates the vacuum cleaner has additional capacity to handle an increase of compressed air volume.

Recommendation

Additional efforts be expended toward the mobile road silt collection system development. Collecting samples using the manual road silt collection system is dangerous, very time consuming, and expensive. If a safer and less expensive system to collect accurate samples can be made available, the possibility of assistance in collecting road silt samples throughout the United States is more likely.

WORK ASSIGNMENT TASK 7

At key stages of the study, the contractor shall evaluate the revised silt loading database to determine the mathematical relationships between the road design and use characteristics and the resulting silt loading. The contractor shall report the results of these analyses to the WAM and upon approval share these analyses with the participants of the study. At the completion of the project, the contractor shall prepare a report which documents the information collected, the analyses performed to relate the road design and use characteristics with the measured surface silt loading, the results of the analyses, and a discussion of the uncertainties and variabilities which are not addressed in the analysis and which may cause differences in surface silt loading.

PES collected and analyzed a total of 34 road and curb silt samples. After passing all quality assurance procedures, 16 road silt samples and 13 curb road silt samples remained for road silt analytical study. The quality assurance procedures in place identified two road silt samples and three curb road silt samples that were flawed and should not be used in a national data base. The remaining 16 road silt samples should be representative of road silt loading on four lane highways in Wake and Durham Counties, North Carolina. The curb road silt samples were collected and analyzed to explore the relationship, if any, between road silt loading and silt loading in the corresponding sample curb area. A regression line plot that compares paired sample road to curb silt loading does not show a strong relationship. A copy of this plot is included in Appendix E, along with spreadsheets reflecting the total data pool, information limited to road silt samples, and information limited to curb silt samples.

A complete set of the data forms for each sample, generated by using the new Excel™ workbook discussed earlier, and copies of the linear regression relationship plots for the dependent and independent variables for road silt and curb silt are in Appendix F and G respectively. Trends and relationships are not strong in any of the regression analysis plots. However, those relationships are less likely to be discernable when the number of samples are small. Additional road silt samples should improve the ability to discern what if any relationship exists. Until then, the relationship information of dependent and independent variables from the current data should be used only as an indicator until more samples can be included to improve the confidence level.

WORK ASSIGNMENT TASK 8

The contractor shall image process emission test reports supplied through the WAM from EPA Regional Offices and enter test report summary information into the Source Test Information and Retrieval (STIRS) database. The contractor shall provide support in resolving problems identified by the WAM on using the STIRS database, the RecordStar viewing software, and test report images on CD-ROM disks. As directed by the WAM, the contractor shall revise the users manual for the integrated use of the STIRS database program, RecordStar image viewing program, and the CD-ROM disks containing electronic images of source test reports. As directed by the WAM, the contractor shall perform second level evaluations on identified test reports.

The contractor shall identify those State/local agencies which generally require the collection and analysis of condensible particulate matter during emission testing for Filterable Particulate matter. The contractor shall determine the potential number of external combustion source tests located in the files of those State/Local Agencies which collect condensible particulate emission information. The contractor shall also determine the number of additional non-external combustion source test available within the State/Local

filing system. The contractor shall deliver to the WAM a prioritized list of State/Local offices to be considered for visits. The list of State/Local offices shall include information on the number of external and non-external combustion source tests in the files of the identified State/Local agencies. Upon approval by the WAM, the contractor shall visit the State/Local agencies identified by the WAM to obtain electronic images of emission source tests which includes valid information on emissions and process operations. The contractor shall arrange the source tests by AP-42 Chapter and Section, and archive the information on CD-ROM discs for delivery to the WAM. The contractor shall enter summary information from the source tests into the STIRS database. The contractor shall deliver to the WAM the updated STIRS database

PES identified the State and local agencies that generally require the collection and analysis of condensible particulate during air emission testing. PES determined the potential number of external and nonexternal combustion source tests located in the identified offices, and provided the WAM with a prioritized list of the number of external and nonexternal combustion source tests in the files.

Source test report collection trips where made to four State agencies; the Oregon Department of Environmental Quality (ODEQ), the Pennsylvania Department of Environmental Protection (PDEP), the Texas Natural Resource Conservation Commission (TNRCC), and the Wisconsin Department of Natural Resources (WDNR). A total of 338 source test reports were collected, subjected to a primary review, and scanned onto magneto-optical disks. See Table 2 for a numerical breakdown by agency. Once the source test reports had been assigned to AP-42 sections, the individual source test report files were moved into the appropriate directories and copied onto compact discs. The compact discs have been delivered to the WAM. See Table 3 for a list of the determined AP-42 sections. General information regarding each source test report was entered into the STIRS database.

TABLE 2. NUMBER OF SOURCE TEST REPORTS COLLECTED PER AGENCY

Agency	Number of Source Test Reports Collected
Oregon Department of Environmental Quality	68
Pennsylvania Department of Environmental Protection	61
Texas Natural Resource Conservation Commission	104
Wisconsin Department of Natural Resources	105

TABLE 3. NUMBER OF SOURCE TEST REPORTS PER AP-42 SECTION

AP-42 Section	Number of Source Test Reports[a]
1.1	67
1.2	7
1.3	28
1.4	83
1.5	1
1.6	65
1.10	12
1.11	3
1.x	45
3.1	11
3.2	37
3.3	2
3.4	13
3.x	8
5.1	8
11.30	1
12.2	1

[a]Reports may be listed in more than one AP-42 section.

Recommendation

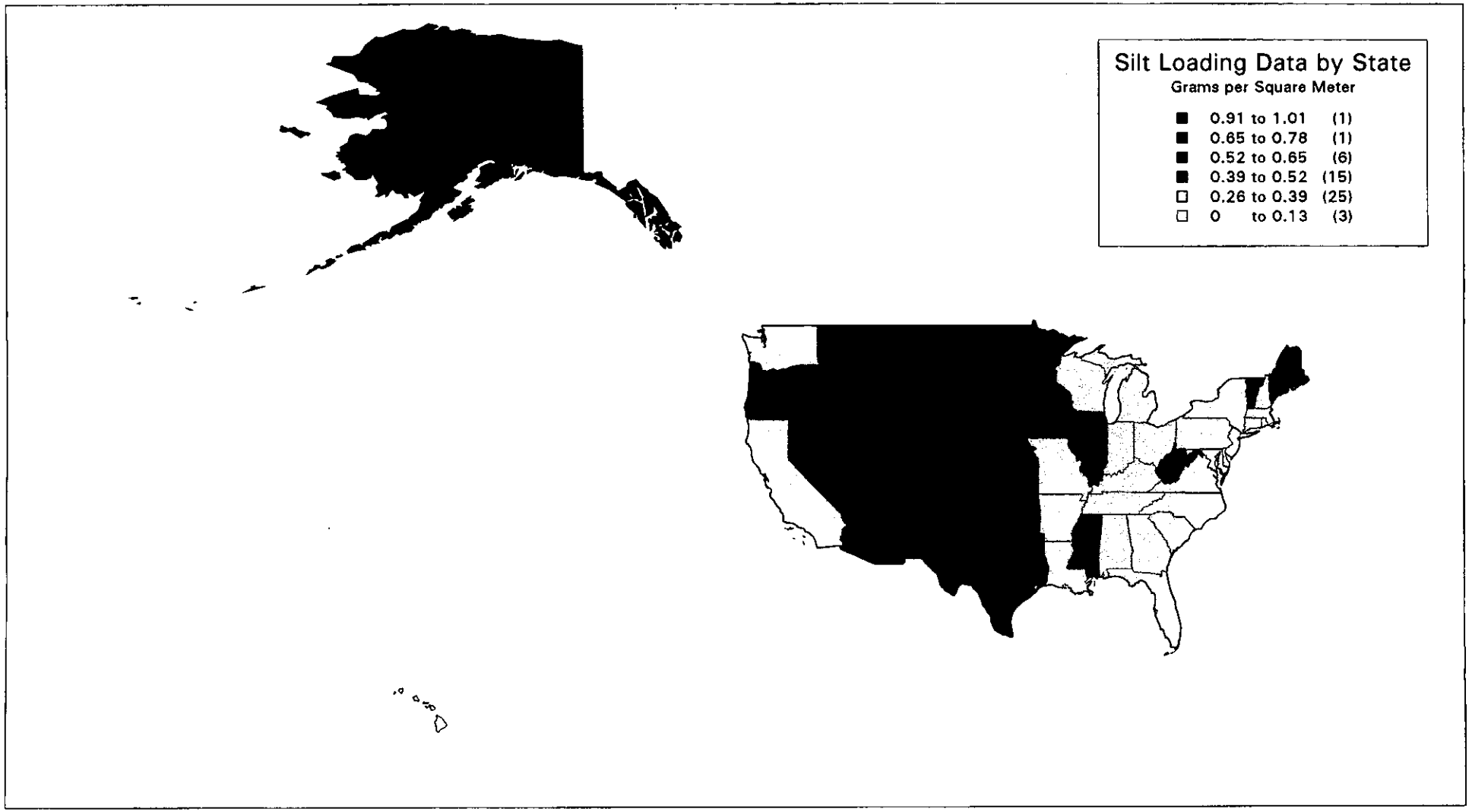
There were some problems encountered during the source test report collection trips. First, more source test reports could have been scanned during the trips had the scanner been able to accommodate two sided pages. Because it will only scan one-sided pages, the double-sided pages must be manually turned over in order to be scanned. This causes a delay because the scanner gives an out of paper message and then the scanning process must be restarted. Second, during the last source test report collection trip to PDEP, the scanner started to sporadically save batches of pages onto the disk. This caused extra time to be spent double

checking each batch and rescanning when necessary. PES recommends that a new double-sided capacity scanner be purchased to avoid the above mentioned problems.

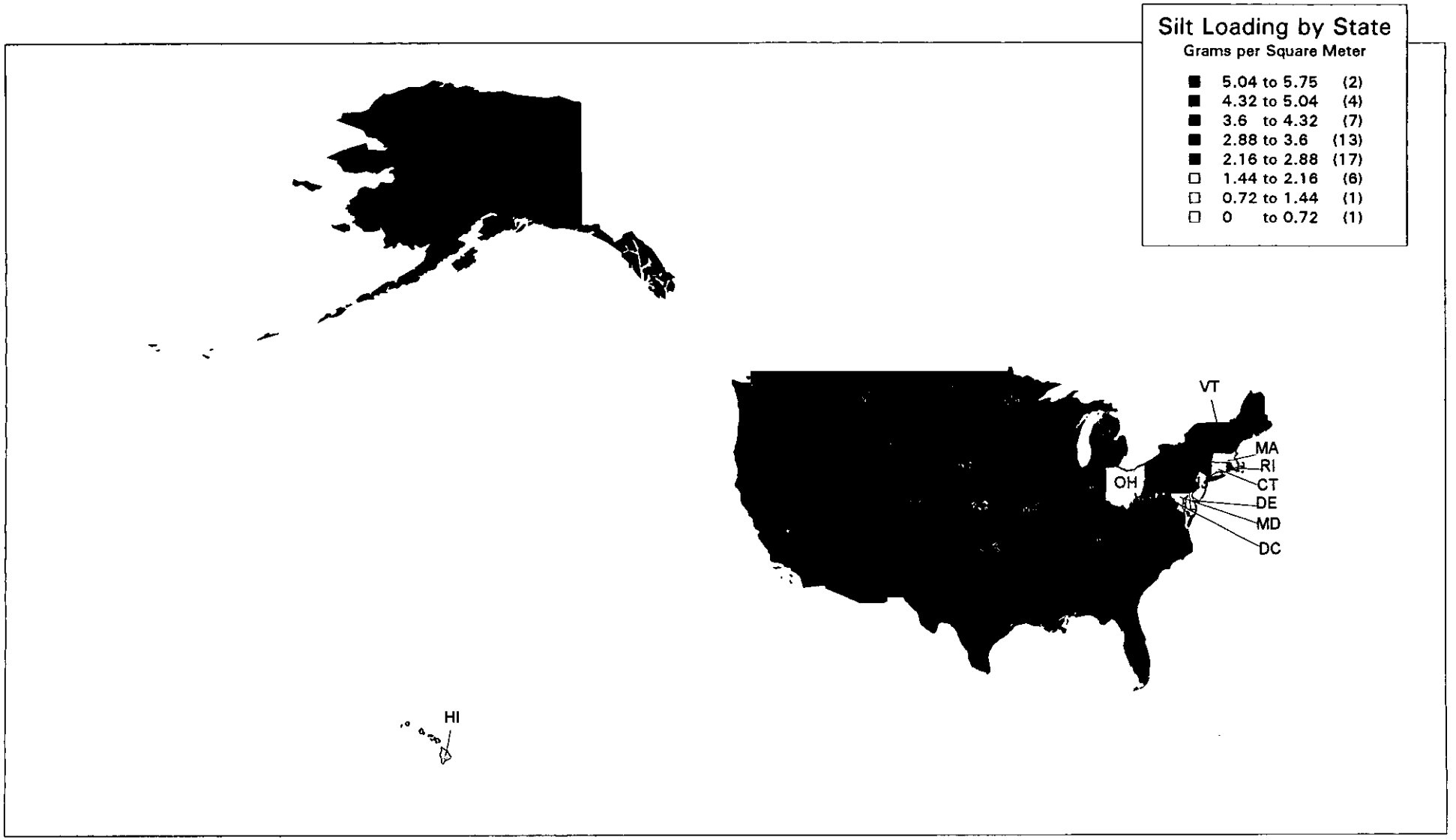
APPENDIX A

Geographical Silt Loading Maps

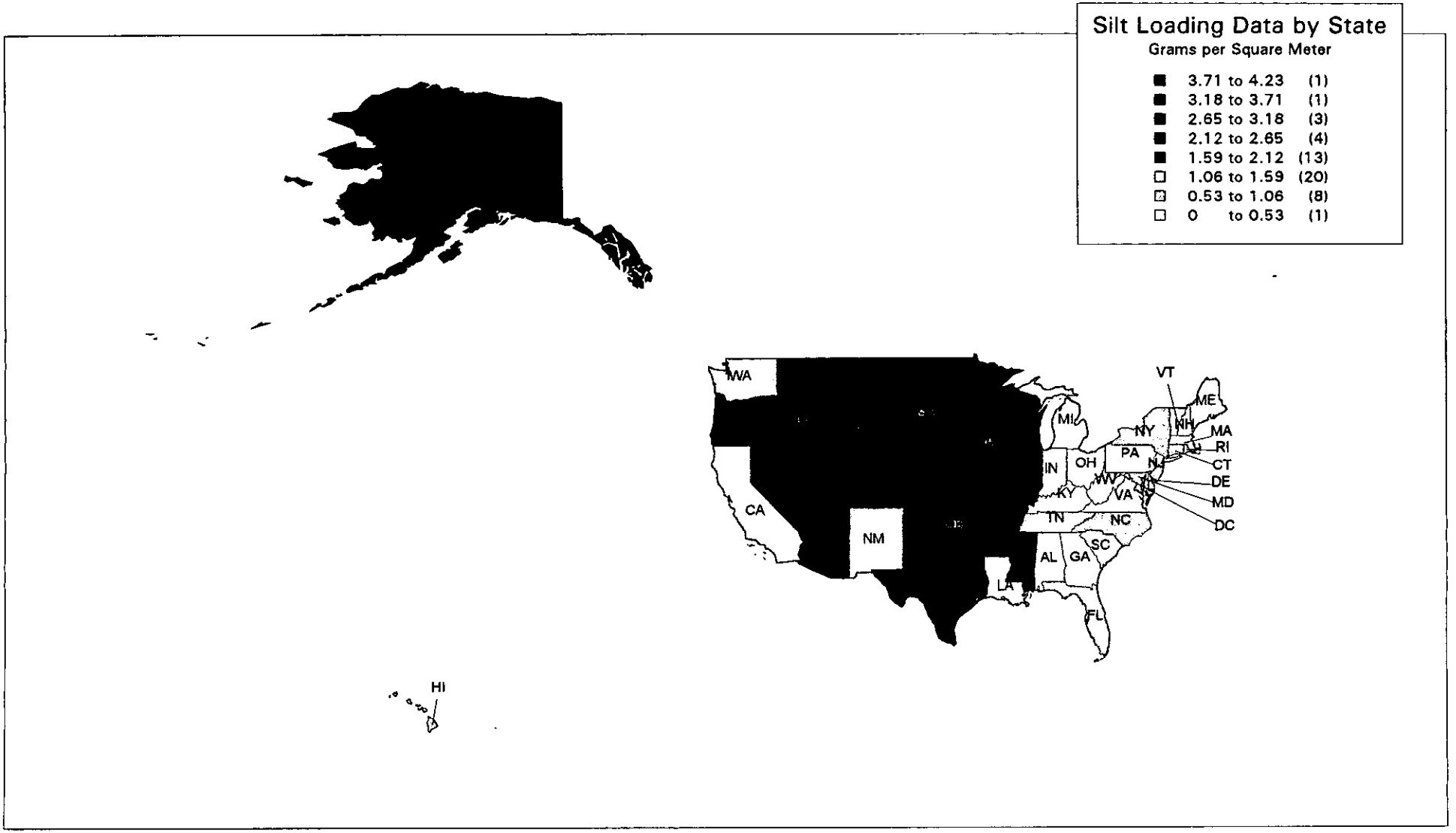
Rural Silt Loading Data - Freeways



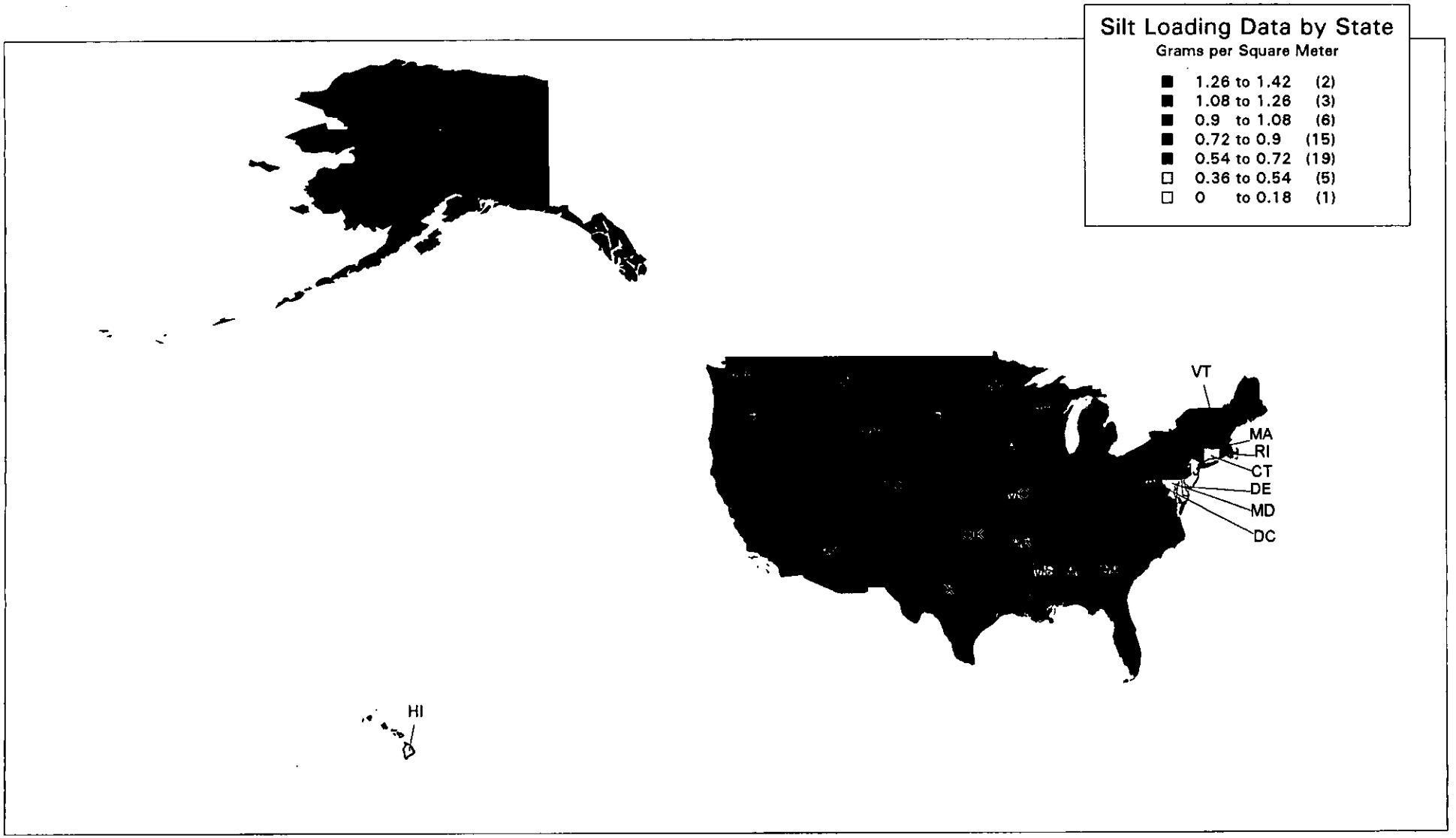
1994 Rural Silt Loading Data - Local Roadways



1994 Rural Silt Loading Data - Collector Roadways

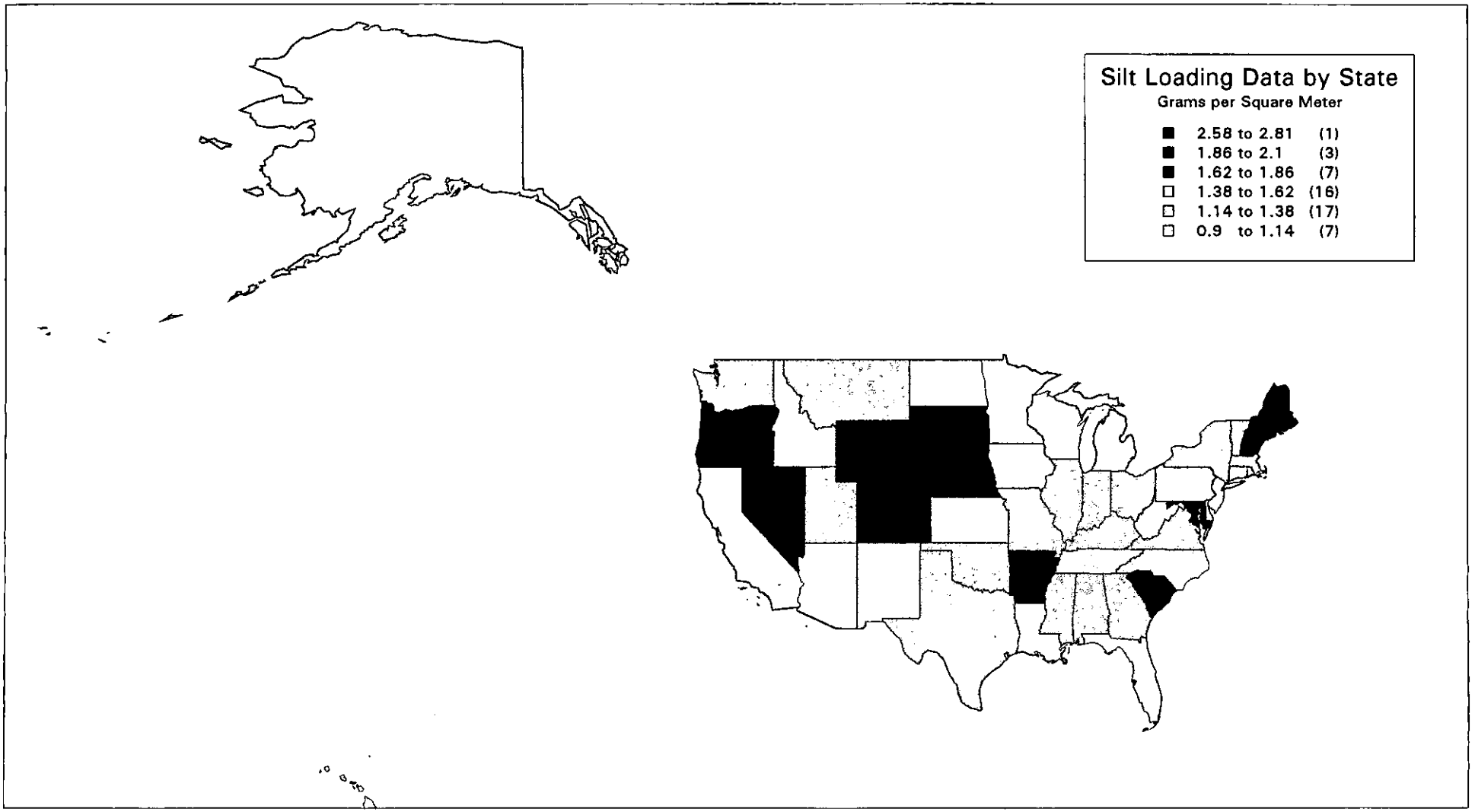


1994 Rural Silt Loading Data - Major Roadways

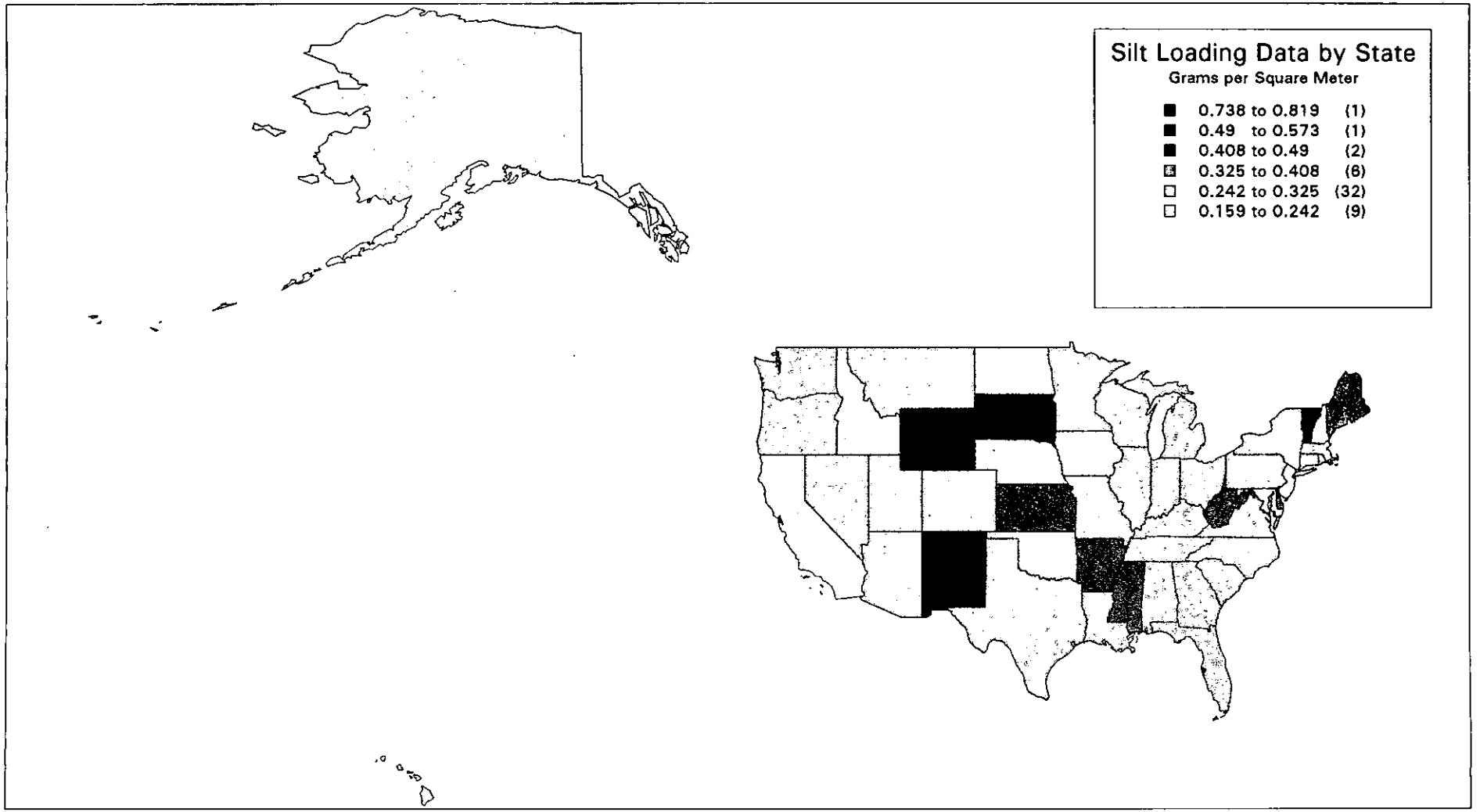


Urban Silt Loading Data - Major Roadways

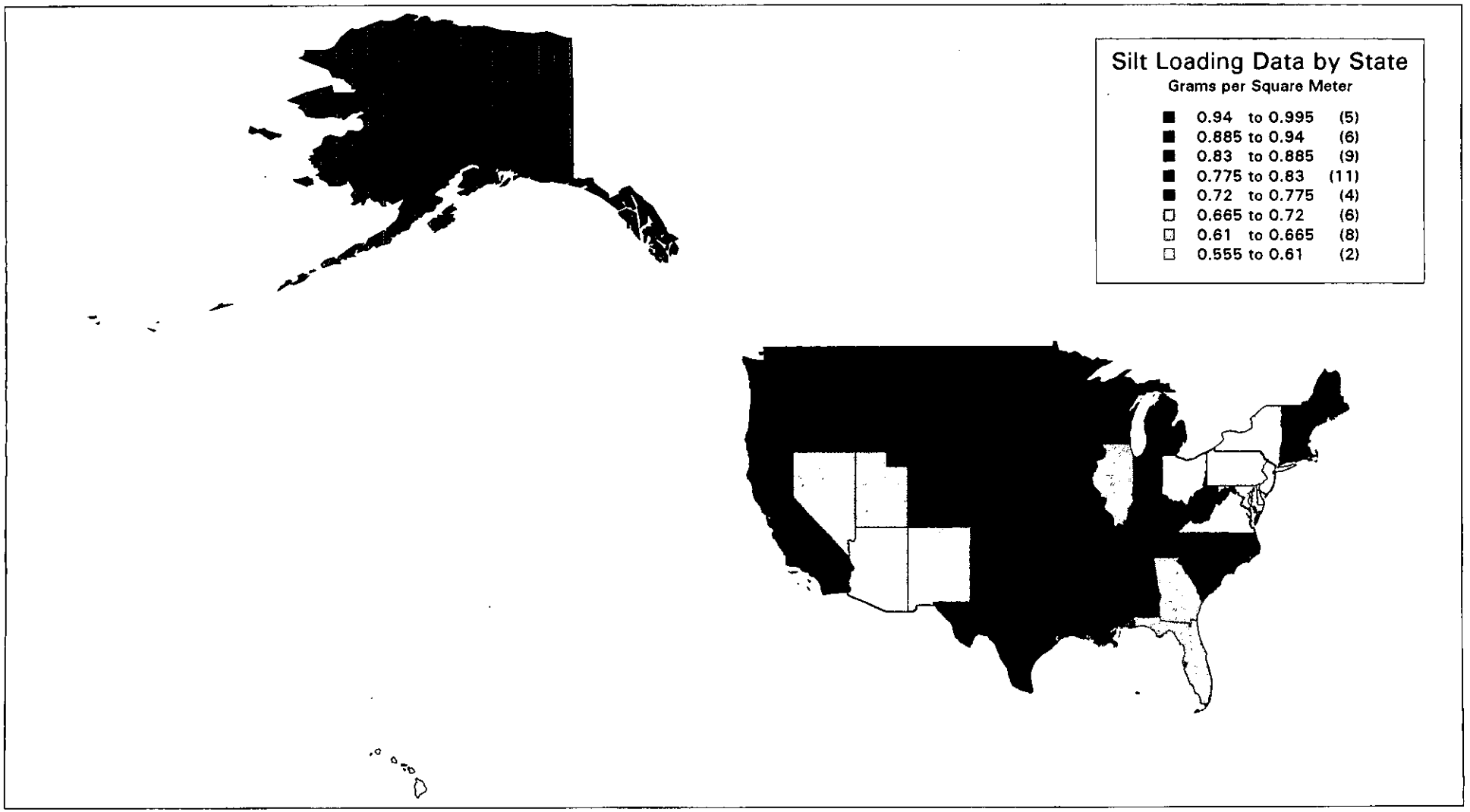
Urban Silt Loading Data - Local Roadways



1994 Urban Silt Loading Data - Freeways



1994 Urban Silt Loading Data - Collector Roadways



APPENDIX B

EPA Regional, State, and Local Contacts

Contract No. 68D30001, WA No. 4-01

Region	Name	Telephone	Comments
EPA Region 1	Matt Cairns	617-565-3583	No interest in participating - could not give me any state or local contacts.
EPA Region 2	Kenneth Eng	212-637-4080	Directed me to another person in his office.
EPA Region 2	Ray Werner	212-637-3951	Mr. Werner believes that the data in NETD for his areas is high by a factor of two. He would like to participate in the study with two non-attainment areas, New York and Puerto Rico. He also made an information request.
EPA Region 3	James Burke	215-597-7934	No interest in participating. However, he did give PES some contacts in West Virginia and Allegheny Co. Pennsylvania.
EPA Region 4	Doug Neely	404-347-2864	Directed to call Kaye Prince.
EPA Region 4	Kaye Prince	404-347-2867	Never returned PES' calls.
EPA Region 4	Steve Scholfield	404-347-3555	No interest in participating.
Allegheny Co., PA.	Cari Weaver	412-578-8101	No interest in participating.
EPA Region 5	John Summerhays	312-886-6067	No interest in participating. However, he did give PES some contacts in Illinois and Michigan.
EPA Region 6	Mary Kemp	214-665-8358	Directed PES to other people.

Region	Name	Telephone	Comments
EPA Region 6	Stanley Sprull	214-665-7212	Indicated that this was not his area of responsibility. He did give PES a list of contacts in Texas, Oklahoma, New Mexico, Arkansas, and Louisiana.
EPA Region 7	Don Toensing	913-551-7446	No interest in participating, However, he did give PES some contacts in Missouri and Nebraska.
EPA Region 8	Cali Vidatich	303-312-6434	No interest in participating, However, she did give PES some contacts in Colorado and Montana.
EPA Region 9	Lisa Thorpe	415-744-1264	No interest in participating.
EPA Region 10	George Lauderdale	206-553-6511	No interest in participating, However, he did give me a contact in the EPA who handles Alaska, and contacts in Idaho, Lane Region Air Pollution Authority, and Washington State University.
EPA Region 10	John Pavitt	907-271-3688	No interest in participating.
WV OAQ	Tim Carroll	304-238-1220	Has interest in participating, but before committing he would like to see additional information.
IL OAQ	Rob Kaleel	217-782-1830	No interest in participating.
MI OAQ	Raj Sinha	313-832-5001	Has some interest in participating, but before committing he would like to see additional information.

Region	Name	Telephone	Comments
TX NRCC	Dana Vermillion	512-239-1000	Indicated that this was not her area of responsibility.
OK OAQ	David Shutz	405-524-1348	No interest in participating.
NM OAQ	Jim Shiveley	505-827-1492	No interest in participating.
LA OAQ	Larry Devillier	504-765-0165	No interest in participating.
AR OAQ	Mike Porta	501-661-2000	No interest in participating.
MO OAQ	Calvin Ku	573-751-4817	No interest in participating.
NE OAQ	Shelley Kaderly	402-471-2189	No interest in participating.
MO OAQ	Gretchen Bennett	406-444-2724	No interest in participating.
CO OAQ	Patrick Cummins	303-629-5450	No interest in participating.
ID OAQ	Don Redline	208-769-1422	Unable to contact.
LRAPA	Jeneane Parisi	541-726-2514	No interest in participating.
WSU	Candace Claybourn	509-335-5055	Ms. Claybourn was unaware of the NETD data and therefore unable to comment.

APPENDIX C

Quality Control Manual

Contract No. 68D30001, WA No. 4-01

QUALITY CONTROL MANUAL

ESTABLISH SILT LOADING DATABASE FOR TYPICAL ROADS FOR USE IN AP-42 SECTION 13.2.1 PAVED ROADS

EPA Contract No. 68D30001
Work Assignment No. 4-01
PES Project No. I401

Prepared for

Mr. Ronald Myers
Emission Factors and Inventory Group
Emissions Monitoring and Analysis Division
U.S. Environmental Protection Agency
Research Triangle Park, NC 27711

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Submitted by

PACIFIC ENVIRONMENTAL SERVICES, INC.
5001 S. Miami Blvd., Suite 300
PO Box 12077
Research Triangle Park, NC 27709-2077
(919) 941-0333, FAX (919) 941-0234

GENERAL OVERVIEW

Paved roads account for more than 27 percent of particulate matter with an aerodynamic diameter less than 10 μm (PM-10) in the current national inventory for particulate matter. The basis of this inventory uses the emission factor presented in Section 13.2.1 of *Compilation of Air Pollutant Emission Factors, Volume I: Stationary Point and Area Sources,* Fifth Edition, January 5, 1995, including Supplement A (AP-42) with a modification of the median silt loading presented for paved roads. There is evidence to suggest that the national inventory overestimates the true emissions significantly. Part of this over estimation may be caused by the silt loading database used to make the national inventory. Sampling data for road silt has been collected in limited localities in the western United States. Such sampling limitations may have created an overestimation of road silt due to sampling following events such as the addition of salt and sand to road surfaces, increasing silt loading on the roadway. The Agency would like to obtain silt loading data more representative of the rest of the United States.

The purpose of this study is to gather road silt samples from roadways that carry major traffic loads. Four lane highways that have a large daily traffic flow pattern fit that definition. Information to be gathered is expected to be added to the national road silt data base as a continuation of data collection efforts used to quantify actual road silt occurrences, particularly along the East Coast.

THE SAMPLING SYSTEM

Sampling procedures will closely follow those described in AP-42 Appendix C.1.2. Road silt samples will be collected manually with a vacuum cleaner. Road traffic will be diverted during the sample collection process. Supporting equipment will include a generator, road safety equipment, and sample containers. Sample areas are to be chosen to reduce the influence of construction projects, agricultural activities, and any activity that may influence the amounts of road silt. The goal is to gather representative samples that can be added to the existing database for road silt. Sample handling procedures are discussed in detail later in this manual.

STATEMENT OF PROJECT OBJECTIVES

The objective of this data collection process is to accurately report road silt amounts found on heavily traveled roadbeds found in the eastern United States.

EXPERIMENTAL DESIGN

The basic design for collecting road silt samples requires the vacuuming of roadbed surfaces, from white line to white line. The designated surface area must be properly measured and vacuumed. Collected samples must be properly identified, transported, and analyzed. The critical measurements are area vacuumed and the mass of the road silt. During road silt analysis, critical measurements are the weighing of equipment and sample materials, and the calculations of moisture and partical size.

SCHEDULE

The sample gathering is scheduled for June and July, 1997 in Durham and Wake counties. Preliminary studies suggest that four lane roadbeds should be selected for study. Traffic diversions on major roads with heavy traffic flow are dangerous and require considerable training using written procedures. Before sampling can begin, site selections must be made, permission gained from the Department of Transportation, equipment rented, team training completed, and laboratory procedures reviewed.

PROJECT ORGANIZATION AND RESPONSIBILITY

Paul Grable will organize and train the collection team. Mike Maret will be responsible for training the lab analysis team. The collection team will be Ken Mullen, Tim Okabayshi, and Paula Frederici. Tim Okabayshi, and Paula Frederici will perform the lab analysis work. Paul Grable will upgrade both the field and laboratory data sheet, and creating an EXCEL™ workbook containing those two forms. He will insert formulas that will calculate the sample area, the silt loading, and the silt fraction for each sample site. Paul Grable will complete the statistic analysis will be performed by Paul Grable. The final report preparation will be completed by Paul Grable.

QUALITY ASSURANCE OBJECTIVES

This project requires careful measurement of the sample area and the following of standard laboratory techniques and procedures. Other than scale calibrations and checking with standard weights, quality assurance procedure will includes monitoring training and following procedures required to collect the samples and analyze them accurately.

Determining QA Objectives

The collection and analysis of road silt samples are not complicated. Primary objectives are the requirements for good planning, following procedures, and analytically

processing samples consistently. Mass balance is to be the QA criteria for sample integrity, laboratory QA, and record keeping accuracy.

Quantitative QA Objectives: Qualitative QA Objectives: Precision, Accuracy, Method Detection Limit, and Completeness

This type of sample collection does not lend itself to multiple redundant sampling. There are many independent variables that contribute to road silt deposition, equilibrium, and removal. Sample density varies from white line to white line, and down the length of the road bed, within the same sample area.

The dependent variable road silt, and is a direct result of the influence of independent variables. One of the goals of this project is to determine, if possible, the relationship of the independent variables to the dependent variable.

Qualitative QA Objectives: Comparability and Representativeness

Comparability is the degree that one sample data set can be compared to another. The comparability of sample sets represents an unknown and the use of statistical analysis to define it is a goal of of this project. Statistics will be used to demonstrate representativeness, the degree to which each sample and the group of samples is indicative of the population.

Other QA Objectives

Mass balance is the analytical check for each of the samples analyzed. The laboratory data sheet will demonstrate the accuracy of the analysis.

What If QA Objectives Are Not Met?

If the QA objectives are not met, then the information will not become a part of the database.

SITE SELECTION AND SAMPLING PROCEDURES

The AP-42 discussions in Section 13.2.1, *Paved Roads,* have guided the planning for site selection and sampling procedures. Using the information, a list of requirements has been generated and will be used to determine if a site is selected for sample gathering. An important step in preparing for collecting road silt samples is to desiccate, tare, and number the vacuum cleaner bags. The vacuum cleaner bags are then individually placed in identically numbered plastic freezer bags, and stored for use at the sampling site.

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Sampling Site Selection

The following is the site criteria to be met prior to gathering road silt samples from the road bed. Safety is of primary concern due to the known hazards of exposing personnel in close proximity to high speed automobile traffic.

1. The topography of the road must permit vehicle drivers enough distance to clearly understand the changing traffic pattern and to safely make the changes necessary to avoid dangerous situations.

2. The sample area for this project must be a four lane road. The four lanes should be homogeneous with regard to the nature of the neighborhood and traffic flow rates.

3. The sample area must be free of construction sites and industrial unpaved drives that would influence road silt distribution.

4. The road surface in a state of normal maintenance. There should not be pot holes or signs of recent construction such as loose gravel.

5. The road surface must be dry with no water puddles visible on the road shoulders.

Sampling Site Description

Multiple sample sites will be picked throughout Durham and Wake counties. Site selection will follow the listed requirements discussed above.

Sampling Procedure

1. Follow the instructions in Appendix A to divert traffic from two lane into one lane.

2. Measure a distance of 50 feet down the middle of the lane in the sampling area. See Appendix B.

3. Measure the width of the lane in three random places from curb white line to the center division line in the sampling area and average them.

4. Measure the depth of the curb from the white line to the curb. If no curb exists, then find an average depth between the white line and the smooth paved surface grass line.
5. Inspect the empty vacuum cleaner interior for foreign materials. Remove a numbered vacuum cleaner bag from the gallon zip-lock freezer bag. Install it in the vacuum cleaner.

6. Vacuum the main road surface between the curb white line and the center division line in the sampling area.

7. Remove the vacuum cleaner bag, inspect the empty vacuum cleaner for foreign material, then install a new bag. This vacuum bag will hold the curb sample, a procedure unique to this project to study the relationship of curb silt fraction and road silt found along the curb, to the road silt recovered from the road surface over which vehicular traffic operates.

8. Vacuum the paved area from the curb white line (including the white line surface area) to the curb or the edge of the end of the paved area along the road.

9. After vacuuming the sample area curb surface, move the sample collection equipment approximately 200 yards down the road. Repeat steps two through four listed above. Using the curb sample bad till in the vacuum cleaner, collect a sample from the curb in an identical manner to step eight.

10. Remove the vacuum cleaner bag, inspect the empty vacuum cleaner for foreign material, then reinstall the first vacuum cleaner bad, originally used to collect the sample from the vehicular road bed. Vacuum the main road surface between the curb white line and the center division line in the sampling area.

11. Follow the instructions in Appendix A to divert traffic from one lane to the lane just sampled.

12. Reposition the sample collection equipment to the traffic lane next to the original road lane sample area. Follow steps two through four. The vacuum cleaner bag in the vacuum cleaner is the one used to collect the road sample, as opposed to the vacuum cleaner bag containing the curb sample.

13. Follow steps seven through nine. Each time a vacuum cleaner bag is changed in the vacuum cleaner, only one freezer bag is to be open at a time to preclude mixing up the vacuum cleaner bags with the numbered freezer bags.

14. Follow the instructions in Appendix A to safely reopen the divert traffic lane back to the normal two lane traffic flow.

Sample Custody

Sample custody is in the hands of the sampling team that collects the samples while filling out the "Sampling Data from Paved Roads" data collection sheet. Bag numbers are

recorded at the site, and become the link between the sample, data collection sheet, and the laboratory analysis documentation. Upon completing the collection of the sample, the road silt collection team returns the vacuum bags holding the sample to the PES lab.

ANALYTICAL PROCEDURES AND CALIBRATION

EPA-Approved Or Other Validated Standard Methods

PES will follow the guidance found in AP-42, Appendix C.1, (reformatted 1/95). See Appendix C.

Nonstandard Or Modified Methods

Not Applicable

Calibration Procedures And Frequency

Follow the calibration procedure required by the electronic digital scale in the PES lab.

DATA REDUCTION, VALIDATION, AND REPORTING

Data Reduction

Data reduction shall be made using the EXCEL™ spread sheet. Statistics used will include multilineal regression and log transform. This will be a coordinated effort by Paul Grable, Vicky Kriegsman, and Robert Wagoner.

Data Validation

In addition to using the data reduction listed above, standard deviations and other tools will be employed to find relationships between the independent variables and the dependent variable.

Data Reporting

PES personnel who collect samples and conduct laboratory analysis procedures on the sample are listed on the data sheets. The final project report will contain a complete discussion of the statistical analysis of collected data.

INTERNAL QUALITY CONTROL CHECKS

Types of QA Checks

Mass balance calculations and scale calibrations are the major QA checks available. QA checks on procedural practices will be conducted during system audits.

PERFORMANCE AND SYSTEM AUDITS

The project manager is responsible for training. After the road silt collection crew is trained, The project manager will make two procedure inspections by acting as an observer during actual collections of sample materials.

The project manager will also follow two samples though the laboratory analysis, insuring that the written laboratory procedures are followed.

CALCULATION OF DATA QUALITY INDICATORS

Common Data Quality Indicators

Road silt collection and sample analysis is not conducive to QC check such as split or replicated samples. The discussion in AP-42 indicates that high traffic flow and high speed travel minimizes the amount of road silt density. The number of independent variables that influence the amount of road silt per area unit creates too much variability to permit side-by-side comparisons of collected samples. Spiked samples are of small value due in part to the simple nature of sifting the sample to size partials.

CORRECTIVE ACTION

If any deviations or misunderstanding of procedures is discovered during system audits, immediate corrective action will be taken to correct it, and effected samples identified. As a precaution to such a problem, samples will be stored for 6 months after the original analysis is completed to permit reanalysis if necessary.

QUALITY CONTROL REPORTS TO MANAGEMENT

A quality control report will be made by the project manager after the system audits are complete.

REFERENCES

1. *Preparation Aids for the Development of Category II Quality /Assurance Project Plans*, EPA/600/8-91/004, February 1991, Office of Research and Development, United States Environmental Protection Agency, Washington DC 20460.

2. *Paved Roads,* AP-42, Section 13.2.1, United States Environmental Protection Agency

3. *Procedures for Sampling Surface/Bulk Dust Loading, AP-42,* Appendix C.1, United States Environmental Protection Agency

4. *Procedures for Laboratory Analysis Of Surface/Bulk Dust Loading Samples*, AP-42, Appendix C.2, United States Environmental Protection Agency.

APPENDIX D

Safety Proceedures for Diverting Traffic Flow

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PES SAFETY PROCEEDURES FOR DIVERTING TRAFFIC FLOW

The following description of the safety procedures is to be followed unless it is deemed to be too dangerous or is modifies. This is written to improve PES employees' understanding of the order of event that need to take place when diverting high speed traffic. All of us depend on the others to keep us safe, but that dependency does not allow complacency or sloppiness to occur. Each of us must stay alert at all times. It is best to be scared, and not to take any chances.

About one-half a mile from the sample area, the truck will pull to the side of the road to permit the placement of "Men Working" sign on the shoulder. One-tenth of a mile further, and a second sign "Merge Left" is placed on the shoulder of the road. Travel an additional one-tenth of a mile and place the sign with the symbol of two lanes converging on the shoulder of the road.

The actual cone placement begins an additional one-tenth of a mile past the last sign placement on the shoulder of the road. The truck is stopped, half on the shoulder of the road and half on the road. One member with a hand held red flag, faces the oncoming traffic and waves the cars into the open lane. Then the second person starts placing the cones (five) at a gradual angle across the road, watching the traffic.

Once the cones are placed across the road, the two people return to the truck. The remaining cones will be placed over a thousand feet (two-tenths of a mile). This area is known as the taper and buffer zone. It is the distance needed for a vehicle, traveling at high speed and crashing through the cone, to safely recover and stop. This is our safety zone.

At the end of the safety zone, the truck will be positioned, facing the traffic, and be between the oncoming traffic and PES employees on the road surface. The road and curb samples will be vacuumed, the truck moved a distance, additional samples collected.

After collecting the sample from one of the two lanes, the truck will return to the last to signs, moving in the normal traffic direction (not against the traffic flow) and change the signs. Then the cones will be moved. When traffic permits, both lanes will be opened. Then one member, with a hand held red flag, will face the oncoming traffic and waves the cars into the second lane. The second person repositions the cones (five) at a gradual angle across the road, while watching the traffic.

The cone and sign recovery will be conducted in the opposite order in which they were set up. After the cones are removed, the truck will be driven in the direction of traffic flow to return to pick up the signs.

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SAFETY RULES:

1. The yellow strobe safety light will be operational after the first arrival stop at the sample area.

2. Hard hats and safety vests will be worn at all times when not in the truck.

APPENDIX E

Sampling Data From Paved Roads

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SAMPLING DATA FROM PAVED ROADS

(Sample in accordance with AP-42, Appendix C.1.2)

Data Sample Collected _____ Sample Bag Identification Number _____

Sampling Location
(e.g., Maple between 3rd and 4th Street) _____
_____
_____

Road area zip code _____

Road description:

1. Number of lanes _____ Lane width _____ Posted traffic speed _____
2. Surface type (e.g., asphalt, concrete): _____
3. Surface conditions (e.g., smooth, weathered): _____
4. Vehicle types (e.g., cars, trucks): _____
5. Estimated daily vehicle traffic load (information available at local DOT):
   a. Measured or estimated? _____
6. Description of neighborhood (agricultural, residential, commercial, industrial: _____
7. Are there construction sites within 0.5 miles, or unpaved road accesses other than residential driveways that would contribute to silt loading? If so, describe the severity of track-out and distance from sample location.
   _____
   _____
8. Describe surrounding *soil type (e.g., loam, sand, clay...)* _____
9. Weather Related Information:
   a. Has it rained in the past 48 hours? (Yes/No) _____
   b. Has winter weather traction material been spread on the road in the *past 30 days* (Yes/No) _____
   c. If so, what type of material (e.g., sand, salt, slag) _____
   d. How heavily was it spread? (lbs/mile/lane) _____
10. Weather conditions (over the past 24 hours)(e.d., sunny, windy): _____
11. Road Sample surface dimensions for this sample

Sample Area		Length (ft)		Width (ft)		Area (ft^2)
1						0
2						0
3						0
4						0

Note: The computer will calculate the area

12. Curb Sample: Road edge description (e.g., curbed, ditch):
    a. Was a curb sample *taken (Yes/No)* _____ b. *If so,* Sample Bag Identification Num. BAG No. _____

Surface dimensions for this sample. (Use a broom to collect any large debris and vacuum area from curb-side white line to curb. If no curb exists, collect the sample from the curb-side white line on hard paved shoulder surface to the beginning of grass or ditch.)

CURB SAMPLE AREAS						
Sample Area		Length (ft)		Width (ft)		Area (ft^2)
1						0
2						0
3						0
4						0

Note: The computer will calculate the area

13. Sample Collection Team:

Sample Collection Team Members (Last names) _____ _____

_____ _____

Organization Collecting Samples _____

Organization Telephone Number _____

APPENDIX F

Laboratory Analytical Procedures

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ANALYTICAL PROCEDURES FOR ROAD SILT STUDY

VACUUM FILTER BAG PREPARATION

Prior to their use in the field, filter bags (hereafter, these shall be referred to as "bags") must be prepared. Received bags are first marked with a unique identification number using a permanent marker. PES has marked each of the bags sequentially, with a letter prefix denoting the bag type. For example, bag number D-001 signifies the first bag of the type used in the Dayton 5Z041B canister vacuum. After marking, the bags are placed into a desiccator for overnight drying.

While the bags are desiccating, the appropriate number of "Zip Lock" bags are prepared as containers for the vacuum bags. These Zip-Lock bags are the plastic freezer bags with a one-gallon capacity (hereafter, the "Zip Lock" bags will be referred to as "pouches"). Each of the pouches are marked with the same identification scheme as the bags are, so that there is one pouch for each bag.

After drying, each bag is placed into its pouch, and the pouch is sealed. From this point on, each bag and pouch are weighed as a single unit for subsequent analysis. The weight of each bag/pouch combination is weighed to the nearest 0.1 g using an analytical balance, and the weight recorded in the logbook.

BAG HANDLING PROCEDURES DURING SAMPLE COLLECTION

During sampling, the bags are kept in the pouches until just prior to use in the canister vacuum. The bag is removed from the pouch, and placed into the canister portion of the vacuum cleaner. The bag is resealed and kept in a safe place during vacuuming operations. After a road silt sample has been collected into the bag, the bag is carefully removed from the canister, and refolded so as not to lose any of the material that has been collected into the bag. The bag is then carefully placed back into its numbered pouch and the bag/pouch pair stored in a safe place for transport to the lab for analysis.

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ANALYTICAL PROCEDURES

Analysis of the collected road silt sample consists of two parts. These are the analysis to determine the moisture content of the sample and the bag, and the analysis to determine the size fractions of the collected material.

Upon receipt in the lab, the bag/pouch combination is weighed to the nearest 0.1 g. The bag is removed from its pouch, laid out on a flat surface, and the ends are carefully cut off. Entrained material in each end is removed and transferred into a tare drying pan. The end folds are opened up so as much material as possible is recovered from in between the folds. Material that is still contained in the bag is transferred to the drying pan by gently shaking the bag and letting the material slide into the pan. After the loose material is transferred to the pan, the bag is once again laid on the flat surface, and the bag is cut open along the length of the bag. The bag is then opened up, and the paper is laid out flat. Using a brush, the remaining dust is carefully swept to one edge of the bag, and into the drying pan. When no more loose material remains, the bag is folded up, placed back into its pouch, and reweighed. The bag and the drying pan are each oven-dried at a temparature of aproximately 75 °C for two hours. After the two hour period has elapsed, the drying pan is removed from the oven and immediatly weighed. The bag is allowed to cool for one or two minutes, then place back into its pouch and reweighed. The wet material and dry material weights are then used to calculate the moisture content of the sample according to the following equation.

$$\%M = \frac{W_i - W_f}{W_i} \times 100$$

where:

% M	=	percent moisture content, by weight
W_i	=	Weight of bag/pouch combination prior to drying, g
W_f	=	Weight of bag/pouch combination after drying, g

After the moisture analysis of the sample is conducted, the material in the drying pan is separated according to size using a mechanical sieve to determine the weight fractions of each of the three size ranges, which are:

<20 mesh particles
particles with sizes between 200 and 20 mesh
>200 mesh particles

Since no further analysis are conducted on the vacuum bag, the bag and its pouch are archived. Any difference in post drying weight and the tare weight of the vacuum cleaner bag is assumed to be due to road silt entrained in the bag.

After all material is transferred into the weighing pan and the weights are recorded, the collected road material is carefully transferred onto the top stage (the 20-mesh pan) of the mechanical seive separator. Extra care must be taken at this point to guard against loss of material. Any fines that stick to the bottom and walls of the pan are carefully brushed from the pan onto the top stage. The lid is then placed onto the 20-mesh sieve, and the crossbar is secured across the seive stages using the lockdown nuts.

Upon starting the mechanical shaker the shaking speed is set at the lowest possible setting. The unit and the elapsed timer are both started at the same time, and the shaker is allowed to stabilize (i.e., the vibrations are fairly steady). After the unit stabilizes, which takes about 10 to 20 seconds, the speed is increased to a setting of "five", as indicated on the front of the shaker. If excessive noise develops, or if the pans can be seen to rotate during the shaking period, the lockdown nuts are re-tightened. After a period of ten minutes, the power to the shaker is cut off and the shaker is allowed to come to a halt. The weight of each pan, and the material that has been collected in each pan is then weighed using an analytical balance, the seive stages are reassembled and the mechanical shaker is started again as before, by starting at a speed of "one" for a few seconds and then adjusting to "five".

At the end of the second ten-minute shaking period, the pans are again removed and weighed. The change in weight of the silt that has collected in the pan is then calculated according to the following equation:

$$\Delta W = \frac{W_{i-1} - W_i}{W_{i-1}} \times 100$$

where:

ΔW = percent increase in weight from the previous weighing
M_{i-1} = Weight of 200-mesh pan and contents
W_{ei} = Tare Weight of 200-mesh pan
i = current analytical interation
$i - 1$ = previous analytical interation

Analyses are conducted until the weight change in the material collected in the pan, (e.g., the silt) is less than three percent for two subsequent analyses. For the purposes of this study any increase in weight of the bag after the material has been removed to the pan is assumed to consist of silt. This value added to the weight fraction of silt determined from the sieving analysis.

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QUALITY ASSURANCE PROCEDURES

Analytical quality assurance procedures consist of ensuring that the balance used for the weighings is properly zeroed and calibrated, and that the drying pans and seive pans and properly tared prior to analysis.

Analytical Procedures Outline

Moisture Analysis

1. Heat oven to a temperature of 75 °C (167 °F).
2. Record the make, capacity, and smallest division of the balance.
3. Calibrate and tare the balance according to the balance's instructions.
4. Weigh the filter bag/pouch combination and record the mass on the data sheet. (The empty filter bag/pouch must be weighed prior to sample collection.)
5. Weigh the drying pan to be used during the moisture analysis, and record the tare weight on the data sheet.
6. Dissect the bag and transfer contents to the tarred drying pan. (See analytical procedure discussion for detailed bag dissection procedure).
7. Weigh the drying pan with the sample and record the mass on the data sheet.
8. Weigh the empty filter bag/pouch combination and record the mass on the data sheet. Place the filter bag into another drying pan.
9. Place the drying pan containing the sample and the drying pan containing the filter bag into the oven for 2 hours.
10. Remove both drying pans from the oven and allow to cool for several minutes.
11. Weight the drying pan containing the sample and record the mass on the data sheet.
12. Place the filter bag back into its corresponding pouch. Weigh the filter bag/pouch combination and record the mass on the data sheet.
13. Calculate the moisture content of the sample and silt collected.

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Sample Separation and Analysis

1. Prior to use, clean and dry each sieve pan to be used in conjunction with the mechanical sieve.

2. Weigh each of the sieve pans and record their masses on the data sheet.

3. Set up the mechanical sieve. Arrange the sieve pans in the following order (from bottom to top): pan, No. 200-mesh pan, and the No. 20-mesh pan.

4. Place the dry sample into the No. 20-mesh pan. Cover the sieve pan. Bolt the lid down.

5. Set the shaking speed at the lowest possible setting ("one") prior to turning on the mechanical sieve.

6. Turn the mechanical sieve on. Allow the unit to stabilize.

7. Turn the shaking speed up to the desired increased shaking speed (:five").

8. Allow the unit to run for an elapsed time of 10 minutes.

9. After the ten minute period, turn the mechanical sieve off and allow the unit to come to a halt.

10. Weigh the bottom pan and record its mass on the data sheet.

11. Reassemble the mechanical sieve and start the mechanical sieve in the same manner as before.

12. After the second 10 minute shaking period, weigh the bottom pan and record its mass on the data sheet.

13. Keep returning the sample to the mechanical sieve until the percent difference of the mass of the bottom pan, between two consecutive runs, is less than 3%. However, do not use the mechanical sieve for more than 4 trials.

14. After the sample has been thoroughly separated, weigh each of the sieve pans and record their masses on the data sheet.

15. Calculate the net mass and the weight fraction of the separated samples.

16. Archive the filter bag/pouch combination.

17. Clean all materials in preparation for the next sample.

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Road Silt Analysis Data Sheet

Analysis Date: _____ Bag ID No.: _____

Collection Location: _____ Analyst: _____

Comments: _____

_____

I. Moisture Analysis

Note: w.b. = wet basis, d.b. = dry basis

Balance properly zeroed and calibrated _____ Date

Bag Contents		**Filter Bag**	
Combined Pan & Sample Weight (w.b.), g	_____	Bag & Pouch Tare Weight, g	_____
Weighing Pan Tare Weight, g	_____	*Bag, Pouch & Sample* Wt, (w.b.), g	_____
Sample Weight (w.b.), g	_____	Bag, Pouch & Silt Wt., brushed (w.b.), g	_____
Combined Pan & Sample Weight (d.b.), g	_____	Silt Weight, (w.b.), g	_____
Sample Weight (d.b.), g	_____	Dried Bag, Pouch & Silt Wt. (d.b.), g	_____
Total Weight (Sample + Silt, d.b.), g	_____ W_i	Silt Weight, (d.b.), g	_____
Total Weight (Sample + Silt, w.b.), g	_____ W_f		

Percent Moisture Content, (w/w) ###

II. Particle Sizing Analysis and Silt Loading

Shaker Run Number	Elapsed Time (min)	Pan Weight, (g)	Change in Pan Weight, (%)
1			First run is NA
2			
3			
4 If neccessary			

	No. 20 Sieve (g)	No. 200 Sieve (g)	Pan (g)
Final Weight, (g)			
Tare Weight, (g)			
Net Weight, %			
Wt. Fraction, %			

Area Swept, m^2 _____

Silt Loading, g/m^2 _____

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APPENDIX G

Mobile Road Silt Collection System
Test Report

MEMORANDUM

TO: Mr. Ronald E. Myers, EPA

FROM: Mr. Paul Grable, PES

DATE: April 10, 1997

SUBJECT: Test Results -- Mobile Silt Collection System for Paved Roads

INTRODUCTION

An engineering study is being conducted to design a truck-mounted (i.e., mobile) silt collection system that will collect silt samples comparable to silt samples collected via the established manual procedure. The mobile system is required to travel at a minimum speed of 3 miles per hour to meet "moving operation caravan" speed requirements, a federal highway guidance procedure that has been adopted by most if not all states. Collecting road silt samples using the moving operation caravan eliminates the need for permits to close traffic lanes and could reduce sample collection costs by as much as 75 percent.

Performance testing to evaluate the feasibility of a mobile silt collection system (i.e., to collect silt samples that are representative of silt samples collected via the manual procedure) is necessary prior to the actual construction of a truck-mounted silt collection system. Two trials have been conducted. The first trial was designed to check the ability of a mobile system to collect known silt loading samples. The second was designed to show equivalence between the manual and mobile collection systems.

The first trial (i.e., Trial 1) was conducted in the parking lot at the PES office at the intersection of I-40 and Miami Boulevard in Research Triangle park, North Carolina. Trial 1 was performed to test the ability of a mobile system to collect known silt loading samples. Trial 1 consisted of two experiments. The first involved the distribution of a known sample that represented a heavy dust loading relative to normal street dust loading. The second experiment used a smaller amount of road dust for the known sample. To differentiate the two experiments, the following labels are used in the discussions of Trial 1: "Trial 1 - Parking Lot: High Silt Loading" and "Trial 1 - Parking Lot: Low Silt Loading."

An area of the parking lot was selected and marked with nylon strings. The strings were set parallel to each other. The area between the strings was manually vacuumed to remove loose material. Then a known sample was distributed on the cleaned area between the parallel strings. The sample area was vacuumed, using a two stage vacuum cleaner, from a moving pickup truck. A PES engineer sat on the truck tailgate and held the vacuum cleaner

nozzle in contact with the parking lot surface. The sample area between the strings was vacuumed with one pass. After changing the vacuum cleaner's bag, the sample area was manually vacuumed to collect any material missed by the mobile collection system. Then a second known sample, much smaller in mass than the first sample, was distributed in the cleaned area. Again the pickup truck was used to collect the sample. PES concluded Trial 1 by analyzing the two samples collected.

The goal of Trial 2 was to show equivalence between the manual and mobile collection systems. The two experiments conducted on the road during Trial 2 involved the retracted or extended vacuum cleaner brush. Trial 2's labels are "Trial 2 - Road Surface: Brush Retracted" and "Trial 2 - Road Surface: Brush Extended."

Trial 2 took place on Old Trenton Road near the North Carolina Fair grounds in Raleigh, North Carolina. A one lane section of the road was selected for this trial. Both systems of road silt collection (i.e., manual and mobile) were used in this trial. The methodology was designed to minimize the effect of variations in road silt distributions over the road surface. Trial 2 consisted of two experiments, one on February 19, 1997, and the second on February 25, 1997. The only known major difference between the two experiments was the position of the vacuum cleaner's nozzle brush. The brush can be retracted into the nozzle, or extended out of the nozzle. During the first experiment the brush was retracted, allowing the metal face of the nozzle to directly contact the road surface. A week later, the same experiment was conducted with the brush extended.

There are five additional sections following this introduction section. The second section discusses the methodology used during the trials. Sampling and analysis, and test results are presented in the third and fourth section. Conclusions and recommended future actions are found in the last two sections. Within these sections are individual discussions related to the four experiments conducted during Trial 1 and Trial 2.

METHODOLOGY

Trial 1 - Parking Lot: High Silt Loading

The parking lot surface area was heavily laden with loose materials. The asphalt surface of the parking lot is as rough or rougher than most secondary roads. However, it was not difficult to push the vacuum cleaner nozzle across the surface, and the vacuum cleaner nozzle did not bounce across the parking lot surface as it was pulled behind the truck. The surface was dry, and there was a slight breeze of 2-3 mph. Two large construction areas are to the south and north of the parking lot.

Two bright yellow nylon strings were placed parallel over a distance of 60 feet, 20 inches apart. The paved parking lot surface between the strings and on either side of the strings was hand vacuumed to remove loose materials. The material collected was analyzed

for partical size distributions in accordance with the AP-42 procedure. Material that did not pass through a 20 mesh screen was discarded. The remaining sample was recombined and distributed between the parallel strings on the cleaned area in the parking lot (i.e., the test area). This seeded test area could be distinguished visually as being covered with sample material, when compared to the cleaned surface on either side of the parallel strings. The sample distribution appeared uneven in several areas. The test area was then vacuumed from a pickup truck traveling at 4 mph. The test area was then manually vacuumed to collect any of the sample missed by the mobile collection. The results of this experiment are reported in the test results section. The known sample weighed 702.0 grams and was distributed over an area of 8.86 m^2, with a calculated average dust loading of 79.3 g/m^2. The silt loading was 11.5 g/m^2.

Trial 1 - Parking Lot: Low Silt Loading

The identical procedures used in the first experiment were followed during the second experiment. The same sample area was used. The difference between the two experiments was the mass of the known sample. A 5 gram sample was distributed over an area of 5.5 m^2, with a calculated average dust loading of 0.9 g/m^2. The silt loading was 0.24 g/m^2.

Approximately two hours elapsed between the manual vacuuming of the test area at the end of the high silt loading experiment (i.e., the manual vacuuming and recovery of any of the sample missed by the mobile collection) and the distribution of the second known sample. The wind was blowing from of the south at approximately 3-5 mph. The test area was vacuumed from the pickup truck traveling at 4 mph. No additional manual vacuuming was done. The samples collected during both experiments in the parking lot were taken to the PES lab for analysis. The vacuum cleaner nozzle's brush was extended during both Trial 1 experiments.

Trial 2 - Road Surface: Brush Retracted Road Trial February 19, 1997

A section of one lane of Old Trenton Road was selected for Trial 2. The section was selected because it was straight and offered approaching automobile drivers a good view of the activity, allowing the work to be performed in a relatively safe environment. Old Trenton Road passes through an agricultural section of North Carolina State property. The sample area was located between two barns with accesses to the road. There were visible mud tracks leading out of the barn access roads, but none in the sample area. During the first experiment, State employees were burning pasture stubble in two fields upwind from the test area. The wind was blowing at 5-10 mph. The road surface consisted of rough asphalt that looked weathered. The surface was rough enough to prevent a measuring tape from being pulled evenly down the road. The end catch of the measuring tape would snag on large aggregate extending out of the road surface, and would cause the end of the tape to bounce up and down on the lane. PES found it difficult to push the vacuum cleaner nozzle across the road surface

manually. The vacuum cleaner nozzle bounced up and down on the road surface when pulled behind the truck, despite best efforts to maintain constant contact. During manual collection of road dust, the operator could distinctly hear large amounts of loose materials being pulled up from uneven areas in the road surface.

Three separate passes were made over a 228 foot section of the sample lane. During the first pass, a single bright yellow string was stretched 18 inches in the lane from the curb-side white line. The center of the 228 foot long string was marked, designating the position where the manually collecting the sample shifted to the opposite side of the string. Mobile collection took place on the opposite side of the string from the manual sample collection. The string position was then repositioned in the center of the lane, equal distant from the white lines, and sampling was repeated. The third string position was 18 inches from the road center white line. Two clean vacuum cleaner bags were used during Trial 2: one for the manually collected sample, and the other for the truck collected sample. No road surface sample area was vacuumed more than once. The vacuum cleaner nozzle's brush was kept in the retracted position during this experiment.

Trial 2 - Road Surface: Brush Extended Road Trial February 25, 1997

The identical testing procedure and collection methods used during the first experiment of Trial 2 were used during this experiment, except the vacuum cleaner nozzle's brush was extended. The same identical road area and lane were used. The wind was blowing across the road at about 10 mph. The roughness of the road surface, even with the brush extended, created the same problems with maintaining contact between the vacuum cleaner's nozzle and the road surface.

SAMPLING AND ANALYSIS

All vacuum cleaner bags used in these experiments were individually tarred, labeled with a unique number, and placed in a sealed plastic freezer bag. The freezer bag was also marked with the same number as the vacuum cleaner bag. Sampling analysis in the PES lab followed the *Procedures For Laboratory Analysis of Surface/Bulk Loading Samples* as discussed in Appendix C.2 of AP-42.

TEST RESULTS

Trial 1 - Parking Lot: High Silt Loading

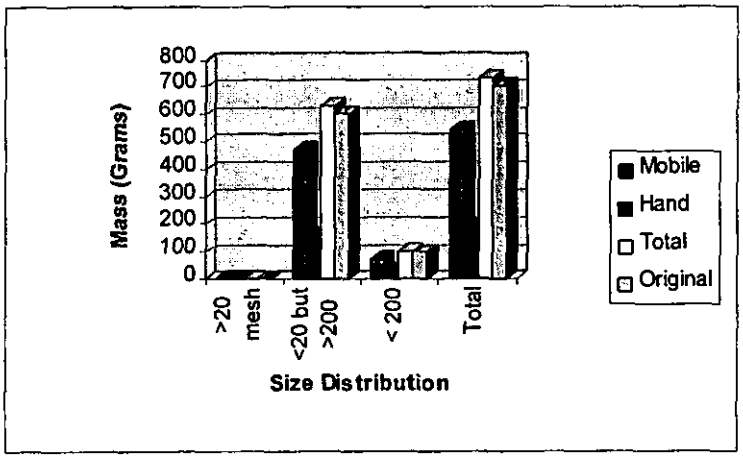
Table A presents the results of the partical size distribution analysis. The column entitled " Distributed Sample" in Table A is the partical size distribution of the sample redistributed over the cleaned parking lot surface. The mobile system was used to recollect the material. It was visually obvious that not all the sample had been successfully recovered. The

entire surface between the strings was then vacuumed by hand to collect the remainder of the sample material. The column labeled "Total" in Table A is the sum of materials recovered from two vacuum cleaner bags. The total mass collected using both the mobile and manual road dust collection systems was found to be 4.5 percent larger than the sample that was seeded originally. Figure A shows the close relationship of the partical size distribution collected using both systems.

Table A. Partical Size Distribution: Trial 1 - Parking Lot: High Silt Loading

Partical Size Distribution	Mobile (g)	Manual (g)	Total (g)	Distributed Sample (g)
>20 mesh	2	1.1	3.1	0
<20 but >200	471.9	158.7	630.6	602.6
< 200 mesh (silt)	71.6	30.5	102.1	100.1
Total	545.5	190.3	735.8	702.7

Figure A. Partical Size Distribution: Trial 1 - Parking Lot: High Silt Loading

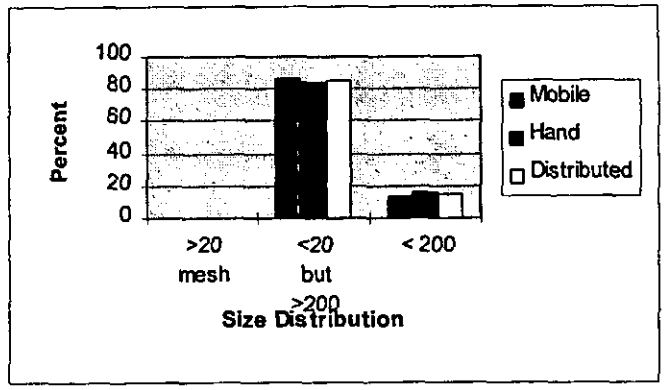


The analyzed percent partical distribution as presented in Table B demonstrates that the mobile system is capable of collecting very close to the same percentage of sample partical size distribution as collected using the manual collection system. Figure B graphically shows the comparison capability of the two systems.

Table B. Percent Partical Size Distribution: Trial 1 - Parking Lot: High Silt Loading

% Partical Size Distribution	Mobile %	Manual %	Distributed Sample %
>20 mesh	0.366	0.578	0
<20 but >200	86.5	83.3	85.7
< 200	13.1	16.0	14.2

Figure B. Percent Partical Size Distribution: Trial 1 - Parking Lot: High Silt Loading



Trial 1 - Parking Lot: Low Silt Loading

PES prepared a 5.0 gram sample of quarry screenings. The partical size distribution of this second sample was analyzed and is shown under " Distributed Sample" in Table C. This sample was to have been distributed over a 40-square meter area to better represent reported silt loading data. However, during the actual sample distribution effort, PES ran out of sample after spreading it over 5.5 m^2. This sample was collected using the mobile system.

Table C presents the partical size distribution of both the original road dust sample that was seeded and the sample that was then vacuumed from the sample area using the mobile system. More than 21 percent more road dust was collected from the seeded area than was seeded originally. Additionally, 53 percent of the road silt (i.e., sample material that passes through a 200 mess screen) is missing from the sample collected. Figure C shows a graphic comparison of the sample size distribution that was collected to that of the sample that was seeded.

Table C. Partical Size Distribution: Trial 1 - Parking Lot: Low Silt Loading

Partical Size Distribution	Mobile (g)	Distributed Sample (g)
>20 mesh	0.4	0
<20 but >200	5.4	3.7
< 200	0.6	1.3
Total	6.4	5

Figure C. Partical Size Distribution: Trial 1 - Parking Lot: Low Silt Loading

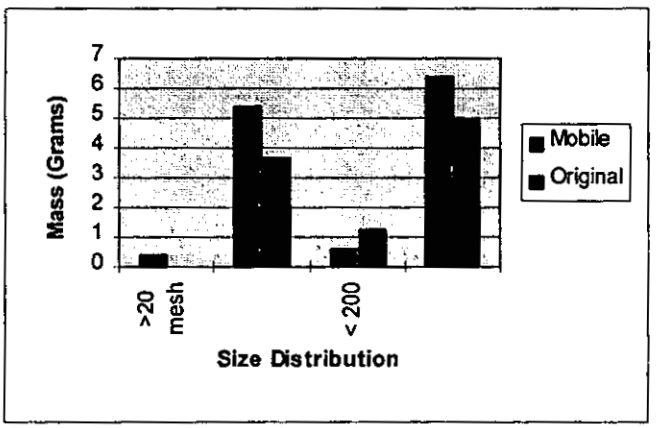
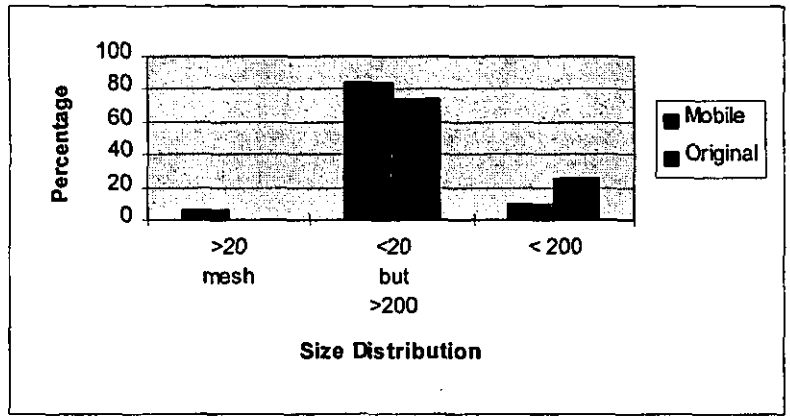


Table D shows the percent partical size distribution. The distributed sample was designed to reflect percentages of road dust that have been recently reported to the EPA. There is a 10 percent increase in mass that passed through the 20 mess screen but not the 200 mess screen. Figure D graphically shows the loss of the road silt component of the seeded sample.

Table D. Percent Partical Size Distribution: Trial 1 - Parking Lot: Low Silt Loading

% Partical Size Distribution	Mobile %	Distributed Sample %
>20 mesh	6.25	0.00
<20 but >200	84.3	74.0
< 200 mesh	9.3	26.0

Figure D. Percent Partical Size Distribution: Trial 1 - Parking Lot: Low Silt Loading



Trial 2 - Road Surface: Brush Retracted Road trial February 19, 1997

Trial 2 was designed to compare the performance of the manual and mobile road silt collection systems under actual road conditions. Safety considerations for personnel required the use of a straight section of road, highly visible to drivers as they approached from either direction. The road surface in the sample area was badly weathered, and consisted of asphalt made with large aggregate. Agricultural activities were taking place on both sides of the road, including the burning of pasture stubble, and tractor traffic to barns and stock yards at either end of the sample area.

During sample collection, PES found that the rough road surface created more friction between the vacuum cleaner nozzle and the asphalt road surface than the friction experienced in the parking lot. During sample collection using the truck, the road surface was rough enough to make nozzle to road surface contact difficult to maintain.

Table E shows that the manual collection system with the nozzle brush retracted, collected 5 times the sample mass collected using the mobile collection system. Table E presents the partical size distribution of the samples collected. Figure E shows the partical size distribution graphically.

Table E. Partical Size Distribution: Trial 2 - Road Surface: Brush Retracted

Partical Size Distribution	Mobile (g)	Manual (g)
>20 mesh	18.6	132.3
<20 but >200	23.7	85.6
< 200 mesh	3.4	13.4
Total	45.7	231.3

Figure E. Partical Size Distribution: Trial 2 - Road Surface: Brush Retracted

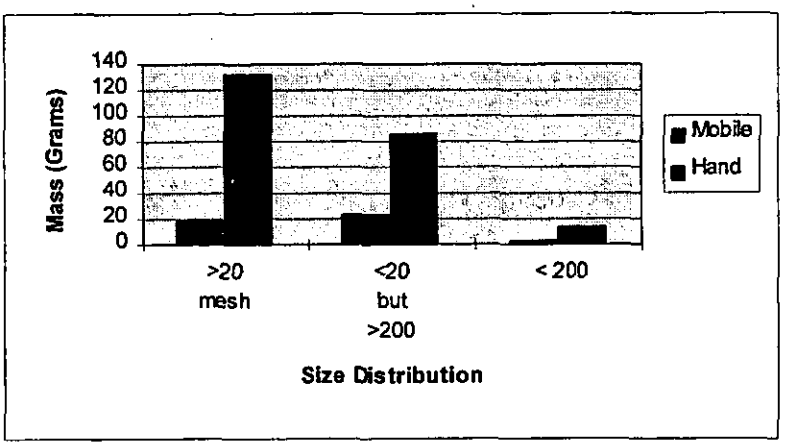
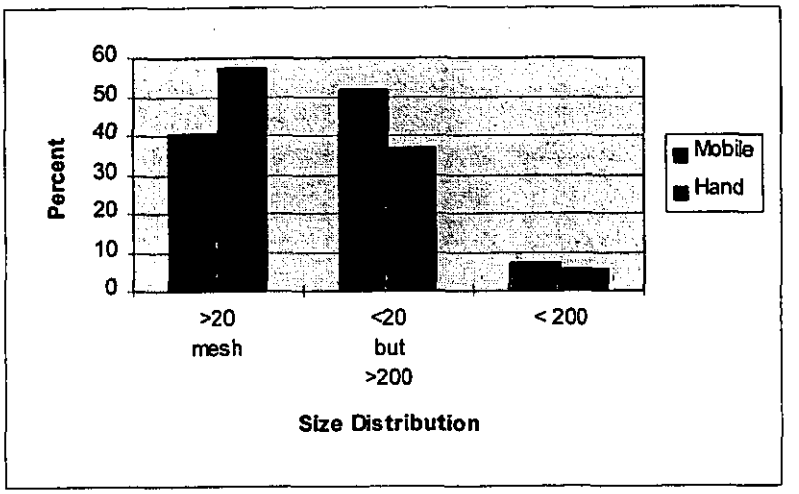


Table F reflects percent partical size distribution of the two samples. The percent partical size distribution presented in Table F indicates that the mobile collection system was more successful in capturing larger sized road dust. Table E shows that the larger sized materials (i.e., material not passing through a 20 mess screen) represents a majority of the mass collected with the manual collection system. It should not be inferred, when viewing the percent partical size distribution of the mobile collection system, that the mobile collection system is more efficient at collecting smaller sized particles. Figure F graphically shows that a relationship between the two collecting systems does not exist.

Table F. Percent Partical Size Distribution: Trial 2 - Road Surface: Brush Retracted

% Partical Size Distribution	Mobile %	Manual %
>20 mesh	40.7	57.1
<20 but >200	51.8	37.0
< 200 mesh	7.43	5.7

Figure F. Percent Partical Size Distribution: Trial 2 - Road Surface: Brush Retracted



Trial 2 - Road Surface: Brush Extended Road trial February 25, 1997

The results from the road test conducted on February 19, 1997, indicated a performance problem existed for the mobile system under certain road conditions. During Trial 2, the vacuum cleaner nozzle's brush was retracted. The experiment with the brush extended was performed to find out if the use of the vacuum cleaner nozzle brush would improve the performance of the mobile system. To minimize changing testing variables, the test was conducted over the same area, using identical sampling procedures. Even with the brush extended, there was more friction than was that experienced during the parking lot tests.

Table G presents the partical size distributions of the samples collected with the nozzle brush extended. Again, the manual collection system captured roughly 500 percent more mass than the mobile collection system, and that the majority of the mass collected using the manual collection system consisted of material that could not be passed through a 20 mess screen (i.e., greater than 75 microns in diameter). These facts mimic the results of the road manual sample collection with the nozzle brush retracted. Figure G graphically represent Table G.

Table G. Partical Size Distribution: Trial 2 - Road Surface: Brush Extended

Partical Size Distribution	Mobile (g)	Manual (g)
>20 mesh	29.5	161.6
<20 but >200	16.8	60.5
< 200 mesh	2.9	10.4
Total	49.2	232.5

Figure G. Partical Size Distribution: Trial 2 - Road Surface: Brush Extended

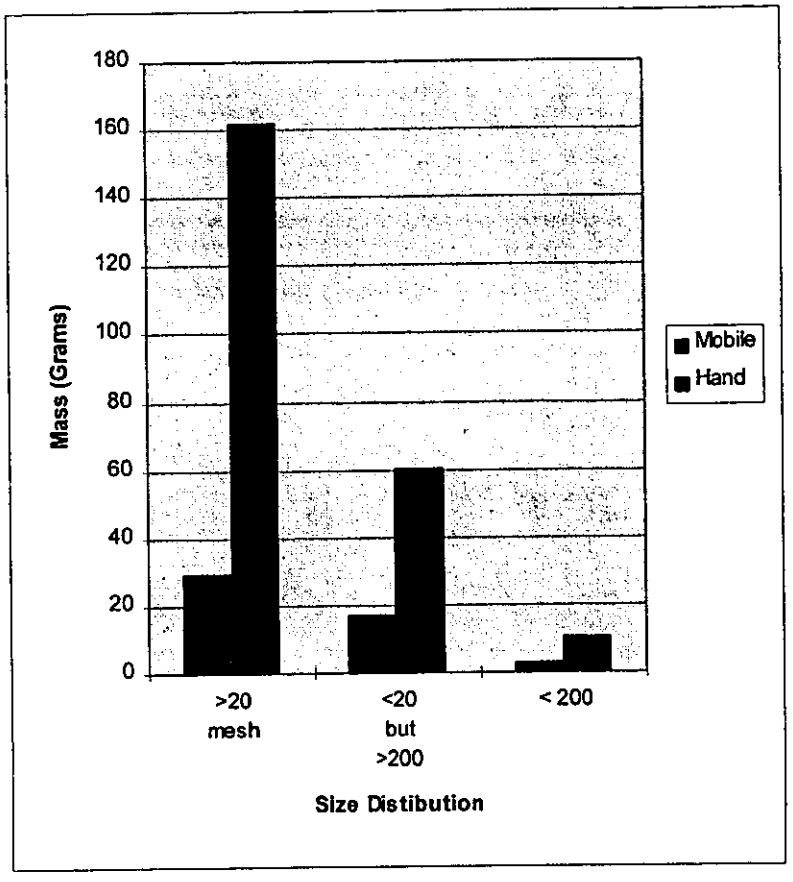
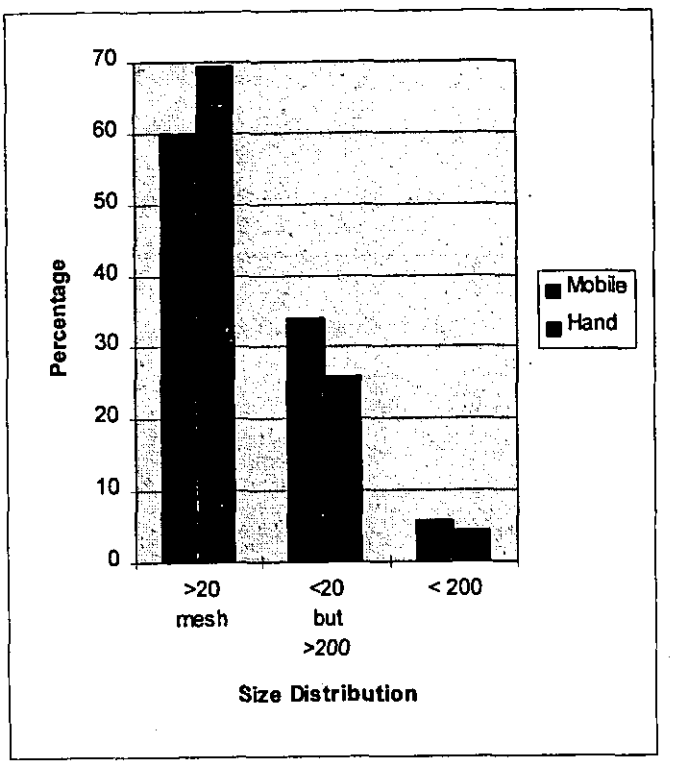


Table H presents the percent partical size distribution of the two samples collected by the manual and mobile collection systems with the nozzle brush extended. There is a stronger correlation in the percent partical size distribution of the two samples when the nozzle brush is extended. Figure H shows this improved correlation, when compared to Figure F.

Table H. Percent Partical Size Distribution: Trial 2 - Road Surface: Brush Extended

% Partical Size Distribution	Mobile %	Manual %
>20 mesh	60.0	69.5
<20 but >200	34.1	26.0
< 200 mesh	5.9	4.5

Figure H. Percent Partical Size Distribution: Trial 2 - Road Surface: Brush Extended



CONCLUSIONS

Trial 1 - Parking Lot: High Silt Loading

- There exists an upper limit of road silt density at which the mobile system will be unable to collect 100 percent of the sample.
- The percent partical size distribution for both samples were very close, as shown in Figure B.

Trial 1 - Parking Lot: Low Silt Loading

- The mobile system captured more sample material than was seeded.
- The mobile system failed to collect all of the road silt sample seeded.

The reasons for these results are not known. However, the additional material may have been deposited from two adjacent construction sites during the two hours that lapsed between the parking lot surface cleaning and the time when the small sample was seeded. The

mobile system's failure to recover all of the road silt seeded might be that part of the road silt was blown away from the trial area during the seeding process.

Trial 2 - Road Surface: Brush Retracted

- Surface roughness reduces the ability of a mobile collection system to collect accurate samples.
- This trial exceeded that limit.
- No comparable samples were collected.
- The manual system collected a sample almost 5 times larger than the mobile system.

Trial 2 - Road Surface: Brush Extended

- The same sampling problem (i.e., surface roughness) existed with the brush extended as was discovered after Trial 2 with the brush retracted.
- The manual system collected a sample almost 5 times larger than the mobile system.
- The percent partical size distribution for the experiment with the brush extended shows a stronger correlation between samples than the percent partical size distribution for the experiment with the brush retracted.

The rough road surface with its weathered crevices and large asphalt aggregate limited the amount of material the mobile system could capture. Particulate matter in the deep cracks was exposed to the mobile system only 25 percent as long as particulate was exposed to the manual system. Over-the-ground-speed of the nozzle from the truck was slightly faster than 4 mph. Ground speed of the nozzle during manual sample collection was less than 1 mph. The asphalt aggregate sticking up on the road surface made it difficult to maintain contact between the vacuum nozzle and the road when using the mobile system.

Table I presents the silt loading calculated for Trial 1 and Trial 2 experiments. These silt loading values are in the range of the silt loading values reported in AP-42 , Table 13.2.1-3. *Nonindustrial Paved Road Sampling Data.*

Sample Silt Loading Table I	
Sample Name	**Silt Loading (g/m^2)**
Trial 1 - Parking Lot: High Silt Loading	
Distributed Sample	11.298
Total Sample Collected	11.524
Manual Sample	3.442
Mobile Sample	8.081
Trial 1 - Parking Lot: Low Silt Loading	
Distributed Sample	0.236
Mobile Sample	0.109
Trial 2 - Road Surface: Brush Retracted	
Mobile Sample	0.061
Manual Sample	0.241
Trial 2 - Road Surface: Brush Extended	
Mobile Sample	0.052
Manual Sample	0.188

RECOMMENDED FUTURE ACTIONS

PES recommends that the long term advantages of a mobile road silt collection system warrants continued testing. The additional tests should be conducted on road surfaces more closely associated with normal silt loading. The testing methodology used in Trial 2 appears adequate to ensure sampling equality between the mobile and manual collecting systems. Additional trials will be necessary on road surfaces that may require a permit to reroute traffic. Silt loading numbers recently provided to EPA are approximately 15 percent of the silt load collected during Trial 1 Parking Lot - Small Sample. PES believes additional trials should be made on roads with higher traffic loading to provide lighter silt loading samples.

If the recommended trial results are not satisfactory (i.e., if mobile and manual trial results can not be shown to be nearly equal) then PES recommends that the nozzle design include the use of compressed air to aid in the collection of particles, using the general design guidance from *Improved Street Sweepers for Controlling Inhalable Particulate Matter,* EPA-600/7-84-02, February 1984. Failing these steps, PES recommends discontinuing developmental work on producing a mobile collection system, and use the remaining assets to collect and analyze manually collected samples.

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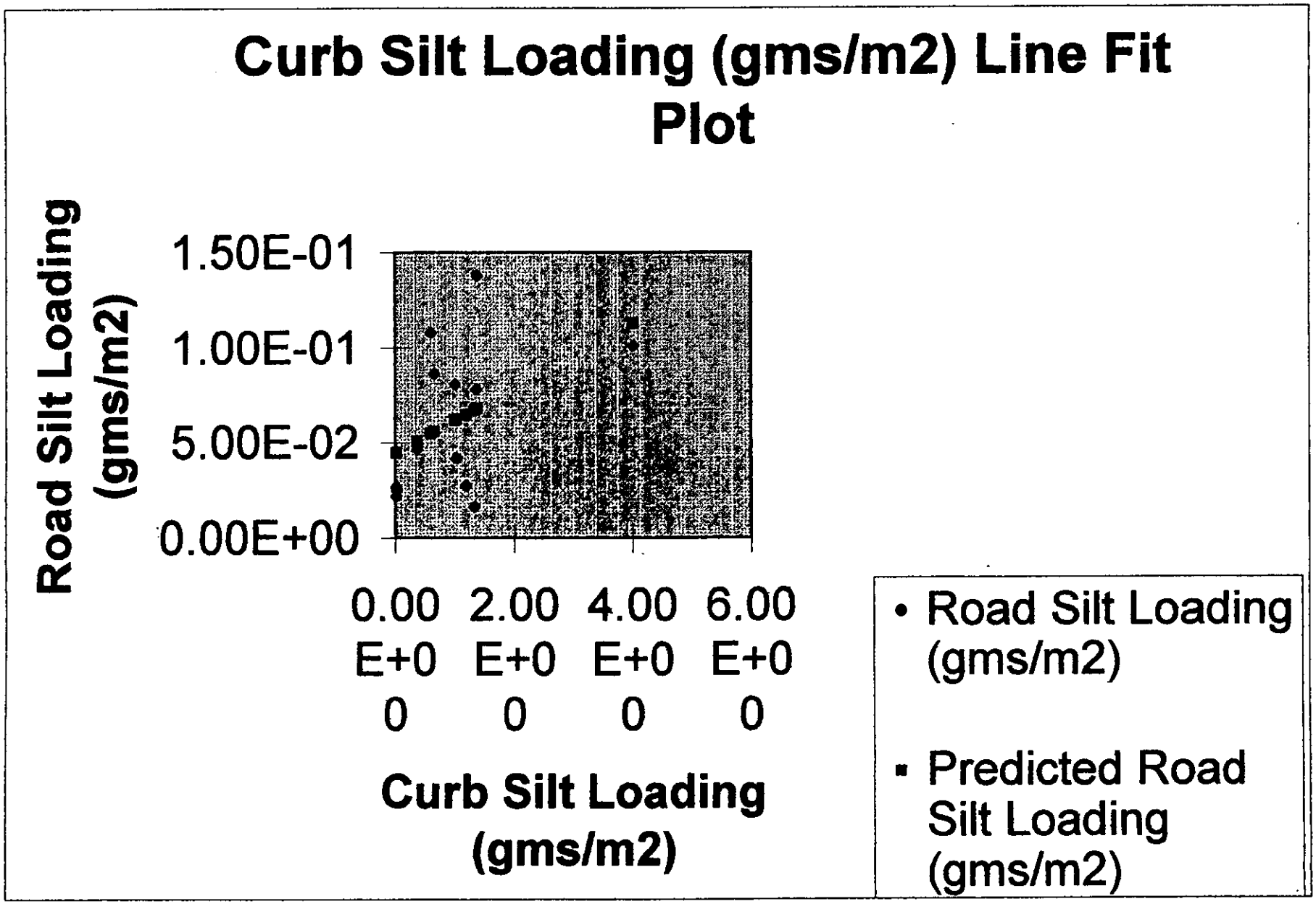
cc: Robert Y. Purcell, PES Project Manager

APPENDIX H

Road and Curb Silt Regression Analysis
and
Sample Data Spreadsheets


Curb Silt Loading (gms/m2) Line Fit Plot
Road Silt Loading (gms/m2)
1.50E-01
1.00E-01
5.00E-02
0.00E+00
0.00 E+0 0
2.00 E+0 0
4.00 E+0 0
6.00 E+0 0
Curb Silt Loading (gms/m2)
Road Silt Loading (gms/m2)
Predicted Road Silt Loading (gms/m2)

Road Silt Analytical Data

										SURROUNDING AREA			WEATHER	
										Neighborhood	Construction Sites	Soil		
Road Sample Bag ID #	Curb Sample Bag ID #	Silt Loading (gms/m^2)	Silt Fraction (%)	Total Silt	Posted Traffic Speed	Surface Type	Surface Conditions	Daily Vehicle Load	Road Edge Type	Neighborhood Description	Construction Sites w/i 0.5 Miles (Y/N)?	Surrounding Soil Type	Rained in Past 48 hrs (Y/N)?	Weather During Past 48 hours?
D-010		2.66E-02	0.055	5.5	55	Concrete	Smooth	11,800	Paved Shoulder	Agri./Res.	N	Clay	N	Sunny/Light Rain
	D-011	1.59E-02	0.096	12.9	55	Concrete	Smooth	11,800	Paved Shoulder	Agri./Res.	N	Clay	N	Sunny/Light Rain
D-012	*None*				N/A	Concrete	Smooth	16,200	Paved Shoulder	Commercial	N	N/A	Y	N/A
Problem	D-013				N/A	Concrete	Smooth	16,200	Paved Shoulder	Commercial	N	N/A	Y	N/A
D-014	*None*	1.01E-01	0.132	21.8	45	Asphalt	Smooth	15,600	Paved Shoulder	Heterogeneous	N	Loam	N	Sunny/Hot
	D-015	4.01E+00	0.112	62	45	Asphalt	Smooth	15,600	Curbed	Heterogeneous	N	Loam	N	Sunny/Hot
D-016		2.52E-02	0.154	4.9	55	Asphalt	Smooth	12,000	Curbed	Heterogeneous	1 Site	Loam	N	Pt Cloudy/Sunny
	D-017	2.24E-02	0.109	3.2	55	Asphalt	Smooth	12,000	Paved Shoulder	Heterogeneous	1 Site	Loam	N	Pt Cloudy/Sunny
D-018		7.80E-02	0.0747	16.6	45	Asphalt	Smooth	5,500	Paved Shoulder	Residential	N	Loam	Y	Sunny/Hot
	D-019	1.36E+00	0.105	38.3	45	Asphalt	Smooth	5,500	Curbed	Residential	N	Loam	Y	Sunny/Hot
D-020		4.62E-02	0.119	10.6	45	Asphalt	Smooth	15,100	Curbed	Commercial	N	Clay	Y	Sunny
	D-021	3.75E-01	0.134	7	45	Asphalt	Smooth	15,100	Curbed	Commercial	N	Clay	Y	Sunny
D-022		8.07E-02	0.18	17.2	45	Asphalt	Smooth	13,300	Curbed	Commercial	N	Clay	N	Sunny/Hot
	D-023	1.01E+00	0.189	17.3	45	Asphalt	Smooth	13,300	Curbed	Commercial	N	Clay	N	Sunny/Hot
D-024		4.17E-02	0.119	9.2	45	Asphalt	N/A	31,200	Curbed	Residential	N/A	Clay	N	Sunny/Hot
	D-025	1.04E+00	0.189	24.9	45	Asphalt	N/A	31,200	Curbed	Residential	N/A	Clay	N	Sunny/Hot
D-026		2.51E-02	0.101	68.3	35	Asphalt	Smooth	14,000	Curbed	Residential	N/A	Clay	N	Partly Cloudy
D-027		2.74E-02	0.114	5.2	45	Asphalt	Smooth	27,000	Curbed	Residential	N/A	Clay	Y	Partly Cloudy
	D-028	1.19E+00	0.077	9.7	45	Asphalt	Smooth	27,000	Curbed	Residential	N/A	Clay	Y	Partly Cloudy
D-029		2.31E-01	0.19	7.9	55	Asphalt	Smooth	16,100	Paved Shoulder	Comm/Res.	N	Loam	Y	Windy/Sunny/ Rainy/Cloudy
Problem	D-030	1.24E-02	0.24	2.5	55	Asphalt	Smooth	16,100	Paved Shoulder	Comm/Res.	N	Loam	Y	Windy/Sunny/ Rainy/Cloudy
D-031	*Problem*				45	Asphalt	Smooth	31,500	Curbed	Commercial	N	Clay	Y	Sunny/ Slight
Problem	D-032				45	Asphalt	Smooth	31,500	Curbed	Commercial	N	Clay	Y	Sunny/ Slight
D-033	*None*	1.01E-01	0.132	21.8	45	Asphalt	Smooth	25,900	Ditch	Agr/Res/Com/Ind	N	Loam	Y	Sunny/Cloudy
D-034		2.21E-02	0.678	47.3	45	Asphalt	Weathered	28,200	Curbed	Comm/Res.	N	Loam	Y	Sunny/Windy/
	D-035	1.71E-02	0.398	69.5	45	Asphalt	Weathered	28,200	Curbed	Comm/Res.	N	Loam	Y	Sunny/Windy/
D-036		1.64E-02	0.453	36.7	55	Asphalt	Smooth	20,100	Paved Shoulder	Comm/Res.	N	Loam	Y	Sunny/Light Rain
	D-037	1.33E+00	0.255	171	55	Asphalt	Smooth	20,100	Paved Shoulder	Comm/Res.	N	Loam	Y	Sunny/Light Rain
D-038		1.08E-01	0.234	23.4	55	Asphalt	Smooth	25,300	Paved Shoulder	Residential	N	Clay	Y	Sunny/Light Rain
	D-039	6.09E-01	0.099	20.6	55	Asphalt	Smooth	25,300	Paved Shoulder	Residential	N	Clay	Y	Sunny/Light Rain
D-040		8.62E-02	0.179	19.3	55	Asphalt	Smooth	36,300	Paved Shoulder	Commercial	N	Clay	Y	Sunny/ Slight
	D-041	6.66E-01	0.226	88	55	Asphalt	Smooth	36,300	Paved Shoulder	Commercial	N	Clay	Y	Sunny/ Slight
D-042		1.38E-01	0.316	28.5	55	Asphalt	Smooth	47,700	Paved Shoulder	Comm/Res.	N	Clay	N	Sunny/Hot
	D-043	1.38E+00	0.354	84.8	55	Asphalt	Smooth	47,700	Paved Shoulder	Comm/Res.	N	Clay	N	Sunny/Hot

Road Silt Only
Site Data

Silt Loading (gms/m^2)	Silt Fraction (%)	Total Silt	Posted Traffic Speed	Surface Type	Surface Conditions	Daily Vehicle Load	Road Edge Type	Neighborhood Description	Construction Sites w/i 0.5 Miles (Y/N)?	Surrounding Soil Type	Rained in Past 48 hrs (Y/N)?	Weather During Past 48 hours?	Road Silt Sample Bag ID #
2.66E-02	0.055	5.5	55	Concrete	Smooth	11,800	Paved Shoulder	Agri./Res.	N	Clay	N	Sunny/Light Rain	D-010
1.01E-01	0.132	21.8	45	Asphalt	Smooth	15,600	Paved Shoulder	Heterogeneous	N	Loam	N	Sunny/Hot	D-014
2.52E-02	0.154	4.9	55	Asphalt	Smooth	12,000	Curbed	Heterogeneous	1 Site	Loam	N	Pt Cloudy/Sunny	D-016
7.80E-02	0.0747	16.6	45	Asphalt	Smooth	5,500	Paved Shoulder	Residential	N	Loam	Y	Sunny/Hot	D-018
4.62E-02	0.119	10.6	45	Asphalt	Smooth	15,100	Curbed	Commercial	N	Clay	Y	Sunny	D-020
8.07E-02	0.18	17.2	45	Asphalt	Smooth	13,300	Curbed	Commercial	N	Clay	N	Sunny/Hot	D-022
4.17E-02	0.119	9.2	45	Asphalt	N/A	31,200	Curbed	Residential	N/A	Clay	N	Sunny/Hot	D-024
2.51E-02	0.101	68.3	35	Asphalt	Smooth	14,000	Curbed	Residential	N/A	Clay	N	Partly Cloudy	D-026
2.74E-02	0.114	5.2	45	Asphalt	Smooth	27,000	Curbed	Residential	N/A	Clay	Y	Partly Cloudy	D-027
2.31E-01	0.19	7.9	55	Asphalt	Smooth	16,100	Paved Shoulder	Comm/Res.	N	Loam	Y	Windy/Sunny/ Rainy/Cloudy	D-029
1.01E-01	0.132	21.8	45	Asphalt	Smooth	25,900	Ditch	Agr/Res/Com/Ind	N	Loam	Y	Sunny/Cloudy	D-033
2.21E-02	0.678	47.3	45	Asphalt	Weathered	28,200	Curbed	Comm/Res.	N	Loam	Y	Sunny/Windy/	D-034
1.64E-02	0.453	36.7	55	Asphalt	Smooth	20,100	Paved Shoulder	Comm/Res.	N	Loam	Y	Sunny/Light Rain	D-036
1.08E-01	0.234	23.4	55	Asphalt	Smooth	25,300	Paved Shoulder	Residential	N	Clay	Y	Sunny/Light Rain	D-038
8.62E-02	0.179	19.3	55	Asphalt	Smooth	36,300	Paved Shoulder	Commercial	N	Clay	Y	Sunny/ Slight	D-040
1.38E-01	0.316	28.5	55	Asphalt	Smooth	47,700	Paved Shoulder	Comm/Res.	N	Clay	N	Sunny/Hot	D-042

Curb Silt Only
Site Data

Silt Loading (gms/m^2)	Silt Fraction (%)	Total Silt	Posted Traffic Speed	Surface Type	Surface Conditions	Daily Vehicle Traffic	Road Edge Type	Neighborhood Description	Construction Sites w/i 0.5 Miles (Y/N)?	Surrounding Soil Type	Rained in Past 48 hrs (Y/N)?	Weather During Past 48 hours?	Curb Sample Bag ID #
1.59E-02	0.096	12.9	55	Concrete	Smooth	11,800	Paved Shoulder	Agri./Res.	N	Clay	N	Sunny/Light Rain	D-011
4.01E+00	0.112	62	45	Asphalt	Smooth	15,600	Curbed	Heterogeneous	N	Loam	N	Sunny/Hot	D-015
2.24E-02	0.109	3.2	55	Asphalt	Smooth	12,000	Paved Shoulder	Heterogeneous	1 Site	Loam	N	Pt Cloudy/Sunny	D-017
1.36E+00	0.105	38.3	45	Asphalt	Smooth	5,500	Curbed	Residential	N	Loam	Y	Sunny/Hot	D-019
3.75E-01	0.134	7	45	Asphalt	Smooth	15,100	Curbed	Commercial	N	Clay	Y	Sunny	D-021
1.01E+00	0.189	17.3	45	Asphalt	Smooth	13,300	Curbed	Commercial	N	Clay	N	Sunny/Hot	D-023
1.04E+00	0.189	24.9	45	Asphalt	N/A	31,200	Curbed	Residential	N/A	Clay	N	Sunny/Hot	D-025
1.19E+00	0.077	9.7	45	Asphalt	Smooth	27,000	Curbed	Residential	N/A	Clay	Y	Partly Cloudy	D-028
1.24E-02	0.24	2.5	55	Asphalt	Smooth	16,100	Paved Shoulder	Comm/Res.	N	Loam	Y	Windy/Sunny/	D-030
1.71E-02	0.398	69.5	45	Asphalt	Weathered	28,200	Curbed	Comm/Res.	N	Loam	Y	Sunny/Windy/	D-035
1.33E+00	0.255	171	55	Asphalt	Smooth	20,100	Paved Shoulder	Comm/Res.	N	Loam	Y	Sunny/Light Rain	D-037
1.38E+00	0.354	84.8	55	Asphalt	Smooth	47,700	Paved Shoulder	Comm/Res.	N	Clay	N	Sunny/Hot	D-043

APPENDIX I

Sample Collection Sheets
From the Excel™ Work Book

SAMPLING DATA FROM PAVED ROADS

(Sample in accordance with AP-42, Appendix C.1.2)

Data Sample Collected 7/16/97 **Sample Bag Identification Number** D-010

Sampling Location
(e.g., Maple between 3rd and 4th Street) 501 North
1.5 miles north of
Bahama Road

Road area zip code _____

Road description:

1. Number of lanes 4 Lane width _____ Posted traffic speed 55 mph
2. Surface type (e.g., asphalt, concrete): concrete
3. Surface conditions (e.g., smooth, weathered): smooth
4. Vehicle types (e.g., cars, trucks): all
5. Estimated daily vehicle traffic load (information available at local DOT): 11,800
   a. Measured or estimated? _____
6. Description of neighborhood (agricultural, residential, commercial, industrial: agricultural/residential
7. Are there construction sites within 0.5 miles, or unpaved road accesses other than residential driveways that would contribute to silt loading? If so, describe the severity of track-out and distance from sample location.
   No
8. Describe surrounding soil type (e.g., loam, sand, clay...) Clay
9. Weather Related Information:
   a. Has it rained in the past 48 hours? (Yes/No) Yes, light rain
   b. Has winter weather traction material been spread on the road in the past 30 days (Yes/No) No
   c. If so, what type of material (e.g., sand, salt, slag) _____
   d. How heavily was it spread? (lbs/mile/lane) _____
10. Weather conditions (over the past 24 hours)(e.d., sunny, windy): sunny with light rain

11. **Road Sample** surface dimensions for this sample

Sample Area		Length (ft)		Width (ft)		Area (m^2)
1		50		11.1		51.5595
2		50		11.1		51.5595
3		50		11.17		51.88465
4		50		11.1		51.5595

Note: The computer will calculate the area. Report 5'-6" as 5.5 ft.

Total Area 206.56 m^2

12. **Curb Sample:** Road edge description (e.g., curbed, ditch): paved shoulder

a. Was a curb sample taken (Yes/No) _____ b. If so, **Sample Bag Identification Num.** BAG No. D-011

Surface dimensions for this sample. (Use a broom to collect any large debris and vacuum area from curb-side white line to curb. If no curb exists, collect the sample from the curb-side white line on hard paved shoulder surface to the beginning of grass or ditch.)

Sample Area		Length (ft)		Width (ft)		Area (m^2)
1		50		4.75		22.06375
2		50		4.75		22.06375
3		50		4		18.58
4		50		4		18.58

Note: The computer will calculate the area. Report 5'-6" as 5.5 ft.

Total Area 81.29 m^2

13. Sample Collection Team:

Sample Collection Team Members (Last names): Grable, Mullen, Okabayashi

Organization Collecting Samples: PES

Organization Telephone Number: (919) 941-0333

Road Silt Analysis Data Sheet

Analysis Date: 8/11/97 | Bag ID No.: D-010

Collection Location: 501 North | Analyst: Frederici

Comments:

I. Moisture Analysis

Note: w.b. = wet basis, d.b. = dry basis

Balance properly zeroed and calibrated: 8/11/97 (Date)

Bag Contents		Filter Bag	
Pan & Sample Weight (w.b.), g	393.1	Bag & Pouch Tare Weight, g	70.5
Weighing Pan Tare Weight, g	294.0	Bag, Pouch & Sample Wt, (w.b.), g	173.8
Sample Weight (w.b.), g	99.1	Bag, Pouch & Silt Wt., brushed (w.b.), g	75.2
Pan & Sample Weight (d.b.), g	392.9	Silt Weight, (w.b.), g	4.7
Sample Weight (d.b.), g	98.9	Dried Bag, Pouch & Silt Wt. (d.b.), g	72.5
[redacted]	W_i	Silt Weight, (d.b.), g	2
[redacted]	W_f		

Percent Moisture Content, %M= 2.79%

$$\%M = \frac{W_i - W_f}{W_i} * 100$$

II. Particle Sizing Analysis and Silt Loading

Shaker Run Number	Elapsed Time (min)	Collection Pan & Silt Weight	Pan Tare Weight	Net	Change in Silt Weight, (%)
1 5	10	503	499.6	3.4	ZERO %
2 5	10	503.1	499.6	3.5	2.86%
3			499.6	-500	100.70%
4			499.6	-500	0.00%

$$\Delta W = \frac{(W_{(i-1)} - W_{(i)})}{W_{(i-1)}} * 100$$

Total Silt, (g) = Filter Silt + Pan Silt

Total Silt, (g) = 5.5

	No. 20 Sieve (g)	No. 200 Sieve (g)	Pan (g)
Final Weight, (g)	386.3	396	503.1
Tare Weight, (g)	382	305	499.6
Net Weight, (g)	4.3	91	3.5
Wt. Fraction, %	4.26%	90.19%	3.47%

Area Swept, m^2 206.56

Silt Loading, g/m^2 2.66E-02

Silt Fraction, % 0.055668

SAMPLE MASS COMPARISION

Dry sample weight	100.9
Sized sample weight	100.8
Net Difference	0.1

Max allowable limit is 2% difference, or for this particular sample: 2.018 gms.

Curb Silt Analysis Data Sheet

Analysis Date: 8/11/97 | Bag ID No.: D-011

Collection Location: 501 North | Analyst: Frederici

Comments: Curb sample

I. Moisture Analysis

Note: w.b. = wet basis, d.b. = dry basis

Balance properly zeroed and calibrated: 8/11/97 (Date)

Bag Contents		Filter Bag	
Combined Pan & Sample Weight (w.	443.8	Bag & Pouch Tare Weight, g	71
Weighing Pan Tare Weight, g	294.3	Bag, Pouch & Sample Wt, (w.b.), g	225.2
Sample Weight (w.b.), g	149.5	Bag, Pouch & Silt Wt., brushed (w.b.), g	75.5
Combined Pan & Sample Weight (d.	443.6	Silt Weight, (w.b.), g	4.5
Sample Weight (d.b.), g	149.3	Dried Bag, Pouch & Silt Wt. (d.b.), g	72.9
[redacted]	W_i	Silt Weight, (d.b.), g	1.9
	W_f		

Percent Moisture Content % 1.82%

$$\%M = \frac{W_i - W_f}{W_i} * 100$$

II. Particle Sizing Analysis and Silt Loading

Shaker Run Number	Elapsed Time (min)	Collection Pan, Silt Weight, (%)	Pan Tare Weight	Pan Net	Change in Silt Weight, (%)
1 5	10	508.1	499.6	8.5	ZERO %
2 5	10	509	499.6	9.4	9.57%
3 5	10	510	499.6	10.4	9.62%
4 5	10	510.6	499.6	11	5.45%

$$\Delta W = \frac{(W_{(i-1)} - W_{(i)})}{W_{(i-1)}} * 100$$

	No. 20 Sieve (g)	No. 200 Sieve (g)	Pan (g)
Final Weight, (g)	400.3	426.3	510.6
Tare Weight, (g)	382	305	499.6
Net Weight, (g)	18.3	121.3	11
Wt. Fraction, %	12.10%	80.22%	7.28%

Total Silt, (g) = Filter Silt + Pan Silt

Total Silt, (g) = 12.9

Area Swept, m^2 81.29

Silt Loading, g/m^2 1.59E-01

Silt Fraction, % 0.096125

SAMPLE MASS COMPARISION

Dry sample weight	151.2
Sized sample weight	152.5
Net Difference	-1.3

Max allowable limit is 2% difference, or for this particular sample: 3.024 gms.

SAMPLING DATA FROM PAVED ROADS

(Sample in accordance with AP-42, Appendix C.1.2)

Data Sample Collected 8/6/97 **Sample Bag Identification Number** D-036

Sampling Location
(e.g., Maple between 3rd and 4th Street) Hwy 64
Between 1435 & Apex H.S.

Road area zip code

Road description:

1. Number of lanes 4 Lane width Posted traffic speed 55
2. Surface type (e.g., asphalt, concrete): asphalt
3. Surface conditions (e.g., smooth, weathered): smooth
4. Vehicle types (e.g., cars, trucks): all
5. Estimated daily vehicle traffic load (information available at local DOT): 20,100
   a. Measured or estimated?
6. Description of neighborhood (agricultural, residential, commercial, industrial: residential, commercial
7. Are there construction sites within 0.5 miles, or unpaved road accesses other than residential driveways that would contribute to silt loading? If so, describe the severity of track-out and distance from sample location.
   No
8. Describe surrounding soil type (e.g., loam, sand, clay...) loam
9. Weather Related Information:
   a. Has it rained in the past 48 hours? (Yes/No) Yes
   b. Has winter weather traction material been spread on the road in the past 30 days (Yes/No) No
   c. If so, what type of material (e.g., sand, salt, slag)
   d. How heavily was it spread? (lbs/mile/lane)
10. Weather conditions (over the past 24 hours)(e.d., sunny, windy): light rain, sunny

11. **Road Sample** surface dimensions for this sample

Sample Area		Length (ft)		Width (ft)		Area (m^2)
1		51.42		11.67		55.7466331
2		51.67		11.58		55.5856559
3		51.67		11.67		56.0176688
4		51.67		11.67		56.0176688

Note: The computer will calculate the area. Report 5'-6" as 5.5 ft.

Total Area 223.37 m^2

12. **Curb Sample:** Road edge description (e.g., curbed, ditch): shouldrer (r,l), ditch (r,l)

a. Was a curb sample taken (Yes/No) Yes b. If so, **Sample Bag Identification Num.** BAG No. D-037

Surface dimensions for *this sample.* (Use a broom to collect any large debris and vacuum area from curb-side white line to curb. If no curb exists, collect the sample from the curb-side white line on hard paved shoulder surface to the beginning of grass or ditch.)

Sample Area		Length (ft)		Width (ft)		Area (m^2)
1		51.42		9.5		45.380721
2		51.67		9.1		43.6813013
3		51.67		4.14		19.872592
4		52		4		19.3232

Note: The computer will calculate the area. Report 5'-6" as 5.5 ft.

Total Area 128.26 m^2

13. Sample *Collection* Team:

Sample Collection Team Members (Last names): Mullen, Gatewood, Okabayashi

Organization Collecting Samples: PES

Organization Telephone Number: (919) 941-0333

Road Silt Analysis Data Sheet

Analysis Date: 8/12/97 | Bag ID No.: D-036

Collection Location: Hwy 64 | Analyst: Frederici

Comments: Between 1435 & Apex High School

I. Moisture Analysis

Note: w.b. = wet basis, d.b. = dry basis

Balance properly zeroed and calibrated: 8/12/97 (Date)

Bag Contents		Filter Bag	
Pan & Sample Weight (w.b.), g	303.2	Bag & Pouch Tare Weight, g	92.6
Weighing Pan Tare Weight, g	222.7	Bag, Pouch & Sample Wt, (w.b.), g	189.7
Sample Weight (w.b.), g	80.5	Bag, Pouch & Silt Wt., brushed (w.b.), g	107
Pan & Sample Weight (d.b.), g	302.9	Silt Weight, (w.b.), g	14.4
Sample Weight (d.b.), g	80.2	Dried Bag, Pouch & Silt Wt. (d.b.), g	105.3
[redacted]	W_i	Silt Weight, (d.b.), g	12.7
[redacted]	W_f		

Percent Moisture Content, %M= 2.11%

$$\%M = \frac{W_i - W_f}{W_i} * 100$$

II. Particle Sizing Analysis and Silt Loading

Shaker Run Number	Elapsed Time (min)	Collection Pan & Silt Weight	Pan Tare Weight	Net	Change in Silt Weight, (%)
1 5	10	522.5	499.7	22.8	ZERO %
2 5	10	523.3	499.7	23.6	3.39%
3 5	10	523.7	499.7	24	1.67%
4		523.7	499.7	24	0.00%

$$\Delta W = \frac{(W_{(i-1)} - W_{(i)})}{W_{(i-1)}} * 100$$

Total Silt, (g) = Filter Silt + Pan Silt

Total Silt, (g) = 36.7

	No. 20 Sieve (g)	No. 200 Sieve (g)	Pan (g)
Final Weight, (g)	394.2	349.1	523.7
Tare Weight, (g)	381.8	304.6	499.7
Net Weight, (g)	12.4	44.5	24
Wt. Fraction, %	13.35%	47.90%	25.83%

Area Swept, m^2 223.37

Silt Loading, g/m^2 1.64E-01

Silt Fraction, % 0.453646

SAMPLE MASS COMPARISION

Dry sample weight	92.9
Sized sample weight	93.6
Net Difference	-0.7

Max allowable limit is 2% difference, or for this particular sample: 1.858 gms.

Curb Silt Analysis Data Sheet

Analysis Date: 8/12/97 **Bag ID No.:** D-037

Collection Location: Hwy 64 Analyst:

Comments: Between 1435 & Apex High School

Note: Shoulder - right lane/ditch - right lane

I. Moisture Analysis

Note: w.b. = wet basis, d.b. = dry basis

Balance properly zeroed and calibrated: 8/12/97 (Date)

Bag Contents		Filter Bag	
Combined Pan & Sample Weight (w.	1137.6	Bag & Pouch Tare Weight, g	92.1
Weighing Pan Tare Weight, g	222.6	Bag, Pouch & Sample Wt, (w.b.), g	1034.7
Sample Weight (w.b.), g	915.2	Bag, Pouch & Silt Wt., brushed (w.b.), g	119.1
Combined Pan & Sample Weight (d.	1134.7	Silt Weight, (w.b.), g	27
Sample Weight (d.b.), g	912.1	Dried Bag, Pouch & Silt Wt. (d.b.), g	117.6
[illegible]	[illegible] W_i	Silt Weight, (d.b.), g	25.5
[illegible]	[illegible] W_f		

Percent Moisture Content % 0.49%

$$\%M = \frac{W_i - W_f}{W_i} * 100$$

II. Particle Sizing Analysis and Silt Loading

Shaker Run Number	Elapsed Time (min)	Collection Pan, Silt Weight, (%)	Pan Tare Weight	Pan Net	Change in Silt Weight, (%)
1 5	10	641.3	499.9	141.4	ZERO %
2 5	10	645.4	499.9	145.5	2.82%
3			499.9	-499.9	129.11%
4			499.9	-499.9	0.00%

$$\Delta W = \frac{(W_{(i-1)} - W_{(i)})}{W_{(i-1)}} * 100$$

	No. 20 Sieve (g)	No. 200 Sieve (g)	Pan (g)
Final Weight, (g)	651.5	802.5	645.4
Tare Weight, (g)	382.1	304.7	499.9
Net Weight, (g)	269.4	497.8	145.5
Wt. Fraction, %	28.73%	53.09%	15.52%

Total Silt, (g) = Filter Silt + Pan Silt

Total Silt, (g) = 171

Area Swept, m^2 128.26

Silt Loading, g/m^2 1.33E+00

Silt Fraction, % 0.255682

SAMPLE MASS COMPARISION

Dry sample weight	937.6
Sized sample weight	938.2
Net Difference	-0.6

Max allowable limit is 2% difference, or for this particular sample: 18.752 gms.

SAMPLING DATA FROM PAVED ROADS

(Sample in accordance with AP-42, Appendix C.1.2)

Data Sample Collected 8/8/97 **Sample Bag Identification Number** D-042

Sampling Location
(e.g., Maple between 3rd and 4th Street) US 64 past Neuse River

Road area zip code _____

Road description:

1. Number of lanes 4 Lane width _____ Posted traffic speed 55
2. Surface type (e.g., asphalt, concrete): asphalt
3. Surface conditions (e.g., smooth, weathered): smooth
4. Vehicle types (e.g., cars, trucks): all
5. Estimated daily vehicle traffic load (information available at local DOT): 47,700
   a. Measured or estimated? _____
6. Description of neighborhood (agricultural, residential, commercial, industrial: residential/commercial
7. Are there construction sites within 0.5 miles, or unpaved road accesses other than residential driveways that would contribute to silt loading? If so, describe the severity of track-out and distance from sample location.
   No
8. Describe surrounding soil type (e.g., loam, sand, clay...) clay
9. Weather Related Information:
   a. Has it rained in the past 48 hours? (Yes/No) No
   b. Has winter weather traction material been spread on the road in the past 30 days (Yes/No) No
   c. If so, what type of material (e.g., sand, salt, slag) _____
   d. How heavily was it spread? (lbs/mile/lane) _____
10. Weather conditions (over the past 24 hours)(e.d., sunny, windy): hot, sunny

11. **Road Sample** surface dimensions for this sample

Sample Area		Length (ft)		Width (ft)		Area (m^2)
1		51.42		11.75		56.1287865
2		51.33		11.67		55.6490602
3		50.67		9.92		46.6958506
4		50.33		10.17		47.5514317

Note: The computer will calculate the area. Report 5'-6" as 5.5 ft.

Total Area 206.03 m^2

12. **Curb Sample:** Road edge description (e.g., curbed, ditch): shoulder (r/l), ditch (l)

a. Was a curb sample taken (Yes/No) Yes b. If so, **Sample Bag Identification Num.** BAG No. D-043

Surface dimensions for this sample. (Use a broom to collect any large debris and vacuum area from curb-side white line to curb. If no curb exists, collect the sample from the curb-side white line on hard paved shoulder surface to the beginning of grass or ditch.)

Sample Area		Length (ft)		Width (ft)		Area (m^2)
1		51.42		4.5		21.496131
2		51.33		3.25		15.4978103
3		50.67		2.67		12.5683388
4		50.33		3.33		15.5699378

Note: The computer will calculate the area. Report 5'-6" as 5.5 ft.

Total Area 65.13 m^2

13. Sample Collection Team:

Sample Collection Team Members (Last names): Mullen, Okabayashi

Organization Collecting Samples: PES

Organization Telephone Number: (919) 941-0333

Road Silt Analysis Data Sheet

Analysis Date: 8/12/97 | Bag ID No.: D-042

Collection Location: US 64 | Analyst: Frederici

Comments: Past Neuse River

I. Moisture Analysis

Note: w.b. = wet basis, d.b. = dry basis

Balance properly zeroed and calibrated: 8/12/97 (Date)

Bag Contents		Filter Bag	
Pan & Sample Weight (w.b.), g	312.8	Bag & Pouch Tare Weight, g	91.1
Weighing Pan Tare Weight, g	222.7	Bag, Pouch & Sample Wt, (w.b.), g	191
Sample Weight (w.b.), g	90.1	Bag, Pouch & Silt Wt., brushed (w.b.), g	100.3
Pan & Sample Weight (d.b.), g	312.4	Silt Weight, (w.b.), g	9.2
Sample Weight (d.b.), g	89.7	Dried Bag, Pouch & Silt Wt. (d.b.), g	98.5
[redacted]	W_i	Silt Weight, (d.b.), g	7.4
[redacted]	W_f		

Percent Moisture Content, %M= 2.22%

$$\%M = \frac{W_i - W_f}{W_i} * 100$$

II. Particle Sizing Analysis and Silt Loading

Shaker Run Number	Elapsed Time (min)	Collection Pan & Silt Weight	Pan Tare Weight	Net	Change in Silt Weight, (%)
1 5	10	520.4	499.6	20.8	ZERO %
2 5	10	520.7	499.6	21.1	1.42%
3			499.6	-500	104.22%
4			499.6	-500	0.00%

$$\Delta W = \frac{(W_{(i-1)} - W_{(i)})}{W_{(i-1)}} * 100$$

	No. 20 Sieve (g)	No. 200 Sieve (g)	Pan (g)
Final Weight, (g)	395.8	360.1	520.7
Tare Weight, (g)	382.3	304.7	499.6
Net Weight, (g)	13.5	55.4	21.1
Wt. Fraction, %	13.90%	57.05%	21.73%

Total Silt, (g) = Filter Silt + Pan Silt

Total Silt, (g) = 28.5

Area Swept, m^2 206.03

Silt Loading, g/m^2 1.38E-01

Silt Fraction, % 0.316667

SAMPLE MASS COMPARISION

Dry sample weight	97.1
Sized sample weight	97.4
Net Difference	-0.3

Max allowable limit is 2% difference, or for this particular sample: 1.942 gms.

Curb Silt Analysis Data Sheet

Analysis Date: 8/12/97 **Bag ID No.:** D-043

Collection Location: US 64 Analyst: Frederici

Comments: Past Neuse River

Note: Should (r/l); Ditch (l)

I. Moisture Analysis

Note: w.b. = wet basis, d.b. = dry basis

Balance properly zeroed and calibrated: 8/12/97 (Date)

Bag Contents		Filter Bag	
Combined Pan & Sample Weight (w.	600.3	Bag & Pouch Tare Weight, g	90.8
Weighing Pan Tare Weight, g	222.5	Bag, Pouch & Sample Wt, (w.b.), g	490.3
Sample Weight (w.b.), g	377.8	Bag, Pouch & Silt Wt., brushed (w.b.), g	111.6
Combined Pan & Sample Weight (d.	599.4	Silt Weight, (w.b.), g	20.8
Sample Weight (d.b.), g	376.9	Dried Bag, Pouch & Silt Wt. (d.b.), g	108.3
[redacted]	W_i	Silt Weight, (d.b.), g	17.5
	W_f		

Percent Moisture Content % 1.05%

$$\%M = \frac{W_i - W_f}{W_i} * 100$$

II. Particle Sizing Analysis and Silt Loading

Shaker Run Number	Elapsed Time (min)	Collection Pan, Silt Weight, (%)	Pan Tare Weight	Pan Net	Change in Silt Weight, (%)
1 5	10	563	499.7	63.3	ZERO %
2 5	10	565.9	499.7	66.2	4.38%
3 5	10	567	499.7	67.3	1.63%
4			499.7	-499.7	113.47%

$$\Delta W = \frac{(W_{(i-1)} - W_{(i)})}{W_{(i-1)}} * 100$$

Total Silt, (g) = Filter Silt + Pan Silt

Total Silt, (g) = 84.8

	No. 20 Sieve (g)	No. 200 Sieve (g)	Pan (g)
Final Weight, (g)	538.5	459.3	567
Tare Weight, (g)	382.3	304.7	499.7
Net Weight, (g)	156.2	154.6	67.3
Wt. Fraction, %	39.60%	39.20%	17.06%

Area Swept, m^2 65.13

Silt Loading, g/m^2 1.30E+00

Silt Fraction, % 0.354219

SAMPLE MASS COMPARISION

Dry sample weight	394.4
Sized sample weight	395.6
Net Difference	-1.2

Max allowable limit is 2% difference, or for this particular sample: 7.888 gms.

SAMPLING DATA FROM PAVED ROADS

(Sample in accordance with AP-42, Appendix C.1.2)

Data Sample Collected 7/18/97 **Sample Bag Identification Number** D-012

Sampling Location
(e.g., Maple between 3rd and 4th Street) Alexander between Miami Blvd and Page Rd

Road area zip code _____

Road description:

1. Number of lanes 4 Lane width 11' + 10" Posted traffic speed _____
2. Surface type (e.g., asphalt, concrete): concrete
3. Surface conditions (e.g., smooth, weathered): smooth
4. Vehicle types (e.g., cars, trucks): all
5. Estimated daily vehicle traffic load (information available at local DOT): 16.2
   a. Measured or estimated? _____
6. Description of neighborhood (agricultural, residential, commercial, industrial: commercial
7. Are there construction sites within 0.5 miles, or unpaved road accesses other than residential driveways that would contribute to silt loading? If so, describe the severity of track-out and distance from sample location.
   No
8. Describe surrounding soil type (e.g., loam, sand, clay...) _____
9. Weather Related Information:
   a. Has it rained in the past 48 hours? (Yes/No) Yes
   b. Has winter weather traction material been spread on the road in the past 30 days (Yes/No) No
   c. If so, what type of material (e.g., sand, salt, slag) _____
   d. How heavily was it spread? (lbs/mile/lane) _____
10. Weather conditions (over the past 24 hours)(e.d., sunny, windy): _____

11. **Road Sample** surface dimensions for this sample

Sample Area		Length (ft)		Width (ft)		Area (m^2)
1		50		11.83		54.95035
2		50		12		55.74
3		50		11.83		54.95035
4		50		11.83		54.95035

Note: The computer will calculate the area. Report 5'-6" as 5.5 ft.

Total Area 220.59 m^2

12. **Curb Sample:** Road edge description (e.g., curbed, ditch): paved shoulder (r), curbed (l)

a. Was a curb sample taken (Yes/No) _____ b. If so, **Sample Bag Identification Num.** BAG No. D-013

Surface dimensions for this sample. (Use a broom to collect any large debris and vacuum area from curb-side white line to curb. If no curb exists, collect the sample from the curb-side white line on hard paved shoulder surface to the beginning of grass or ditch.)

Sample Area		Length (ft)		Width (ft)		Area (m^2)
1		50		2		9.29
2		50		1.83		8.50035
3	two	25		0.75		1.741875
4		25		0.75		1.741875

Note: The computer will calculate the area. Report 5'-6" as 5.5 ft.

Total Area 21.27 m^2

13. *Sample Collection Team:*

Sample Collection Team Members (*Last names*): Grable, Mullen, Okabayashi

Organization Collecting Samples: PES

Organization Telephone Number: (919) 941-0333

Road Silt Analysis Data Sheet

Analysis Date: 8/11/97 **Bag ID No.:** D-012

Collection Location: Alexander between Miami & Page Analyst: Frederici

Comments:

I. Moisture Analysis

Note: w.b. = wet basis, d.b. = dry basis

Balance properly zeroed and calibrated: 8/11/97 (Date)

Bag Contents		Filter Bag	
Pan & Sample Weight (w.b.), g	391.5	Bag & Pouch Tare Weight, g	70.5
Weighing Pan Tare Weight, g	294.4	Bag, Pouch & Sample Wt, (w.b.), g	173.9
Sample Weight (w.b.), g	97.1	Bag, Pouch & Silt Wt., brushed (w.b.), g	77.4
Pan & Sample Weight (d.b.), g	391.3	Silt Weight, (w.b.), g	6.9
Sample Weight (d.b.), g	96.9	Dried Bag, Pouch & Silt Wt. (d.b.), g	74.6
[redacted]	W_i	Silt Weight, (d.b.), g	4.1
[redacted]	W_f		

Percent Moisture Content, %M= 2.88%

$$\%M = \frac{W_i - W_f}{W_i} * 100$$

II. Particle Sizing Analysis and Silt Loading

Shaker Run Number		Elapsed Time (min)	Collection Pan & Silt Weight	Pan Tare Weight	Net	Change in Silt Weight, (%)
1	5	10	510.4	499.7	10.7	ZERO %
2	5	10	510.9	499.7	11.2	4.46%
3	5	10	508.1	499.7	8.4	-33.33%
4			508.1	499.7	8.4	0.00%

$$\Delta W = \frac{(W_{(i-1)} - W_{(i)})}{W_{(i-1)}} * 100$$

	No. 20 Sieve (g)	No. 200 Sieve (g)	Pan (g)
Final Weight, (g)	434.3	338.8	508.1
Tare Weight, (g)	382.4	304.6	499.7
Net Weight, (g)	51.9	34.2	8.4
Wt. Fraction, %	51.39%	33.86%	8.32%

Total Silt, (g) = Filter Silt + Pan Silt

Total Silt, (g) = 12.5

Area Swept, m^2 220.59

Silt Loading, g/m^2 5.67E-02

Silt Fraction, % 0.132275

SAMPLE MASS COMPARISION

Dry sample weight	101.0
Sized sample weight	98.6
Net Difference	2.4

Max allowable limit is 2% difference, or for this particular sample: 2.02 gms.

Curb Silt Analysis Data Sheet

Analysis Date: _____ **Bag ID No.:** D-013

Collection Location: _____ Analyst: _____

Comments: _____

I. Moisture Analysis

Note: w.b. = wet basis, d.b. = dry basis

Balance properly zeroed and calibrated: _____ Date

Bag Contents		**Filter Bag**	
Combined Pan & Sample Weight (w.b.), g		Bag & Pouch Tare Weight, g	
Weighing Pan Tare Weight, g		Bag, Pouch & Sample Wt, (w.b.), g	
Sample Weight (w.b.), g	0.0	Bag, Pouch & Silt Wt., brushed (w.b.), g	
Combined Pan & Sample Weight (d.b.), g		Silt Weight, (w.b.), g	0
Sample Weight (d.b.), g	0.0	Dried Bag, Pouch & Silt Wt. (d.b.), g	
[redacted]	W_i	Silt Weight, (d.b.), g	0
	W_f		

Percent Moisture Content % #DIV/0!

$$\%M = \frac{W_i - W_f}{W_i} * 100$$

II. Particle Sizing Analysis and Silt Loading

Shaker Run Number	Elapsed Time (min)	Collection Pan, Silt Weight, (%)	Pan Tare Weight	Pan Net	Change in Silt Weight, (%)
1			0.0	0	ZERO %
2			0.0	0	#DIV/0!
3			0.0	0	#DIV/0!
4			0.0	0	#DIV/0!

$$\Delta W = \frac{(W_{(i-1)} - W_{(i)})}{W_{(i-1)}} * 100$$

	No. 20 Sieve (g)	No. 200 Sieve (g)	Pan (g)
Final Weight, (g)			
Tare Weight, (g)			
Net Weight, (g)	0	0	0
Wt. Fraction, %	#DIV/0!	#DIV/0!	#DIV/0!

Total Silt, (g) = Filter Silt + Pan Silt

Total Silt, (g) = 0

Area Swept, m^2 21.27

Silt Loading, g/m^2 0.00E+00

Silt Fraction, % #DIV/0!

SAMPLE MASS COMPARISION

Dry sample weight	0.0
Sized sample weight	0.0
Net Difference	0.0

Max allowable limit is 2% difference, or for this particular sample: 0 gms.

SAMPLING DATA FROM PAVED ROADS

(Sample in accordance with AP-42, Appendix C.1.2)

Data Sample Collected 7/28/97 **Sample Bag Identification Number** D-024

Sampling Location
(e.g., Maple between 3rd and 4th Street) Cary Pkwy between Branningan and Coorsdale

Road area zip code _____

Road description:

1. Number of lanes 4 Lane width _____ Posted traffic speed 45
2. Surface type (e.g., asphalt, concrete): asphalt
3. Surface conditions (e.g., smooth, weathered): _____
4. Vehicle types (e.g., cars, trucks): all
5. Estimated daily vehicle traffic load (information available at local DOT): 31,200
   a. Measured or estimated? _____
6. Description of neighborhood (agricultural, residential, commercial, industrial: residential
7. Are there construction sites within 0.5 miles, or unpaved road accesses other than residential driveways that would contribute to silt loading? If so, describe the severity of track-out and distance from sample location.

   _____
   _____

8. Describe surrounding soil type (e.g., loam, sand, clay...) clay
9. Weather Related Information:
   a. Has it rained in the past 48 hours? (Yes/No) No
   b. Has winter weather traction material been spread on the road in the past 30 days (Yes/No) No
   c. If so, what type of material (e.g., sand, salt, slag) _____
   d. How heavily was it spread? (lbs/mile/lane) _____
10. Weather conditions (over the past 24 hours)(e.d., sunny, windy): sunny, hot

11. **Road Sample** surface dimensions for this sample

Sample Area		Length (ft)		Width (ft)		Area (m^2)
1		50		12.92		60.0134
2		50		13.17		61.17465
3		50		10.67		49.56215
4		50		10.75		49.93375

Note: The computer will calculate the area. Report 5'-6" as 5.5 ft.

Total Area 220.68 m^2

12. **Curb Sample:** Road edge description (e.g., curbed, ditch): curbed (r), curbed median (l)

a. Was a curb sample taken (Yes/No) Yes b. If so, **Sample Bag Identification Num.** BAG No. D-025

Surface dimensions for this sample. (Use a broom to collect any large debris and vacuum area from curb-side white line to curb. If no curb exists, collect the sample from the curb-side white line on hard paved shoulder surface to the beginning of grass or ditch.)

Sample Area		Length (ft)		Width (ft)		Area (m^2)
1		50		1.83		8.50035
2		50		1.83		8.50035
3		50		0.75		3.48375
4		50		0.75		3.48375

Note: The computer will calculate the area. Report 5'-6" as 5.5 ft.

Total Area 23.97 m^2

13. *Sample* Collection Team:

Sample Collection Team Members (Last names): Gatewood, Okabayashi, White

Organization Collecting Samples: PES

Organization Telephone Number: (919) 941-0333

Road Silt Analysis Data Sheet

Analysis Date: 8/7/97 **Bag ID No.:** D-024

Collection Location: Cary Pkwy Analyst: Frederici

Comments: between Brannigan & Coorsdale

I. Moisture Analysis

Note: w.b. = wet basis, d.b. = dry basis

Balance properly zeroed and calibrated: 8/7/97 (Date)

Bag Contents		Filter Bag	
Pan & Sample Weight (w.b.), g	300.7	Bag & Pouch Tare Weight, g	76
Weighing Pan Tare Weight, g	222.6	Bag, Pouch & Sample Wt, (w.b.), g	158.7
Sample Weight (w.b.), g	78.1	Bag, Pouch & Silt Wt., brushed (w.b.), g	80.8
Pan & Sample Weight (d.b.), g	300.4	Silt Weight, (w.b.), g	4.8
Sample Weight (d.b.), g	77.8	Dried Bag, Pouch & Silt Wt. (d.b.), g	78.1
[redacted]	W_i	Silt Weight, (d.b.), g	2.1
[redacted]	W_f		

Percent Moisture Content, %M= 3.62%

$$\%M = \frac{W_i - W_f}{W_i} * 100$$

II. Particle Sizing Analysis and Silt Loading

Shaker Run Number	Elapsed Time (min)	Collection Pan & Silt Weight	Pan Tare Weight	Net	Change in Silt Weight, (%)
1 5	10	506.3	499.7	6.6	ZERO %
2 5	10	506.7	499.7	7	5.71%
3 5	10	506.8	499.7	7.1	1.41%
4			499.7	-500	101.42%

$$\Delta W = \frac{(W_{(i-1)} - W_{(i)})}{W_{(i-1)}} * 100$$

	No. 20 Sieve (g)	No. 200 Sieve (g)	Pan (g)
Final Weight, (g)	405.5	351.5	506.8
Tare Weight, (g)	381.9	304.6	499.7
Net Weight, (g)	23.6	46.9	7.1
Wt. Fraction, %	29.54%	58.70%	8.89%

Total Silt, (g) = Filter Silt + Pan Silt

Total Silt, (g) = 9.2

Area Swept, m^2 220.68

Silt Loading, g/m^2 4.17E-02

Silt Fraction, % 0.118557

SAMPLE MASS COMPARISION

Dry sample weight	79.9
Sized sample weight	79.7
Net Difference	0.2

Max allowable limit is 2% difference, or for this particular sample: 1.598 gms.

Curb Silt Analysis Data Sheet

Analysis Date: 8/7/97 | Bag ID No.: D-025

Collection Location: Cary Pkwy | Analyst: Frederici

Comments: Between Brannigan & Coorsdale

Note: Curb Sample Area

I. Moisture Analysis

Note: w.b. = wet basis, d.b. = dry basis

Balance properly zeroed and calibrated: 8/7/97 (Date)

Bag Contents		Filter Bag	
Combined Pan & Sample Weight (w.	449.4	Bag & Pouch Tare Weight, g	70.1
Weighing Pan Tare Weight, g	218.6	Bag, Pouch & Sample Wt, (w.b.), g	308.3
Sample Weight (w.b.), g	230.8	Bag, Pouch & Silt Wt., brushed (w.b.), g	77.7
Combined Pan & Sample Weight (d.	448.7	Silt Weight, (w.b.), g	7.6
Sample Weight (d.b.), g	230.1	Dried Bag, Pouch & Silt Wt. (d.b.), g	75.2
[redacted]	W_i	Silt Weight, (d.b.), g	5.1
[redacted]	W_f		

Percent Moisture Content % 1.34%

$$\%M = \frac{W_i - W_f}{W_i} * 100$$

II. Particle Sizing Analysis and Silt Loading

Shaker Run Number	Elapsed Time (min)	Collection Pan, Silt Weight, (%)	Pan Tare Weight	Pan Net	Change in Silt Weight, (%)
1 5	10	517.2	499.7	17.5	ZERO %
2 5	10	518.2	499.7	18.5	5.41%
3 5	10	518.9	499.7	19.2	3.65%
4 5	10	519.5	499.7	19.8	3.03%

$$\Delta W = \frac{(W_{(i-1)} - W_{(i)})}{W_{(i-1)}} * 100$$

	No. 20 Sieve (g)	No. 200 Sieve (g)	Pan (g)
Final Weight, (g)	485.7	411.3	519.5
Tare Weight, (g)	381.8	304.7	499.7
Net Weight, (g)	103.9	106.6	19.8
Wt. Fraction, %	44.18%	45.32%	8.42%

Total Silt, (g) = Filter Silt + Pan Silt

Total Silt, (g) = 24.9

Area Swept, m^2 23.97

Silt Loading, g/m^2 1.04E+00

Silt Fraction, % 0.189354

SAMPLE MASS COMPARISION

Dry sample weight	235.2
Sized sample weight	235.4
Net Difference	-0.2

Max allowable limit is 2% difference, or for this particular sample: 4.704 gms.

SAMPLING DATA FROM PAVED ROADS

(Sample in accordance with AP-42, Appendix C.1.2)

Data Sample Collected 7/29/97 **Sample Bag Identification Number** D-026

Sampling Location
(e.g., Maple between 3rd and 4th Street) Duke Street
Between Green & Knox

Road area zip code

Road description:

1. Number of lanes 2 Lane width Posted traffic speed 35
2. Surface type (e.g., asphalt, concrete): asphalt
3. Surface conditions (e.g., smooth, weathered): smooth
4. Vehicle types (e.g., cars, trucks): both
5. Estimated daily vehicle traffic load (information available at local DOT): 14,000
   a. Measured or estimated?
6. Description of neighborhood (agricultural, residential, commercial, industrial: residential
7. Are there construction sites within 0.5 miles, or unpaved road accesses other than residential driveways that would contribute to silt loading? If so, describe the severity of track-out and distance from sample location.
   Gravel & weathered residential driveways contribute to trackout
8. Describe surrounding soil type (e.g., loam, sand, clay...) clay
9. Weather Related Information:
   a. Has it rained in the past 48 hours? (Yes/No) No
   b. Has winter weather traction material been spread on the road in the past 30 days (Yes/No) No
   c. If so, what type of material (e.g., sand, salt, slag)
   d. How heavily was it spread? (lbs/mile/lane)
10. Weather conditions (over the past 24 hours)(e.d., sunny, windy): partly cloudy

11. **Road Sample** surface dimensions for this sample

Sample Area		Length (ft)		Width (ft)		Area (m^2)
1		50		10.75		49.93375
2		50		11.1		51.5595
3		50		18.33		85.14285
4		50		18.33		85.14285

Note: The computer will calculate the area. Report 5'-6" as 5.5 ft.

Total Area 271.78 m^2

12. **Curb Sample:** Road edge description (e.g., curbed, ditch): curbed, but no shoulder area to collect curb sample

a. Was a curb sample taken (Yes/No) _____ b. If so, **Sample Bag Identification Num.** BAG No. None

Surface dimensions for this sample. (Use a broom to collect any large debris and vacuum area from curb-side white line to curb. If no curb exists, collect the sample from the curb-side white line on hard paved shoulder surface to the beginning of grass or ditch.)

Sample Area		Length (ft)		Width (ft)		Area (m^2)
1						0
2						0
3						0
4						0

Note: The computer will calculate the area. Report 5'-6" as 5.5 ft.

Total Area 0.00 m^2

13. Sample Collection Team:

Sample Collection Team Members (Last names)	Gatewood Okabayashi	White
Organization Collecting Samples	PES	
Organization Telephone Number	(919) 941-0333	

Road Silt Analysis Data Sheet

Analysis Date: 8/7/97 **Bag ID No.:** D-026

Collection Location: Duke Street Analyst: Frederici

Comments: Between Green & Knox

I. Moisture Analysis

Note: w.b. = wet basis, d.b. = dry basis

Balance properly zeroed and calibrated: 8/7/97 (Date)

Bag Contents		Filter Bag	
Pan & Sample Weight (w.b.), g	894.5	Bag & Pouch Tare Weight, g	69.7
Weighing Pan Tare Weight, g	211.3	Bag, Pouch & Sample Wt, (w.b.), g	766
Sample Weight (w.b.), g	683.2	Bag, Pouch & Silt Wt., brushed (w.b.), g	82
Pan & Sample Weight (d.b.), g	886.3	Silt Weight, (w.b.), g	12.3
Sample Weight (d.b.), g	675.0	Dried Bag, Pouch & Silt Wt. (d.b.), g	78.3
[redacted]	W_i	Silt Weight, (d.b.), g	8.6
[redacted]	W_f		

Percent Moisture Content, %M= 1.71%

$$\%M = \frac{W_i - W_f}{W_i} * 100$$

II. Particle Sizing Analysis and Silt Loading

Shaker Run Number	Elapsed Time (min)	Collection Pan & Silt Weight	Pan Tare Weight	Pan Net	Change in Silt Weight, (%)
1 5	10	553.5	499.6	53.9	ZERO %
2 5	10	557.9	499.6	58.3	7.55%
3 5	10	559.3	499.6	59.7	2.35%
4			499.6	-500	111.95%

$$\Delta W = \frac{(W_{(i-1)} - W_{(i)})}{W_{(i-1)}} * 100$$

	No. 20 Sieve (g)	No. 200 Sieve (g)	Pan (g)
Final Weight, (g)	626.2	676.8	559.3
Tare Weight, (g)	381.9	304.7	499.6
Net Weight, (g)	244.3	372.1	59.7
Wt. Fraction, %	35.74%	54.43%	8.73%

Total Silt, (g) = Filter Silt + Pan Silt

Total Silt, (g) = 68.3

Area Swept, m^2 271.78

Silt Loading, g/m^2 2.51E-01

Silt Fraction, % 0.101021

SAMPLE MASS COMPARISION

Dry sample weight	683.6
Sized sample weight	684.7
Net Difference	-1.1

Max allowable limit is 2% difference, or for this particular sample: 13.672 gms.

Curb Silt Analysis Data Sheet

Analysis Date: _____ **Bag ID No.:** None

Collection Location: _____ Analyst: _____

Comments: _____

I. Moisture Analysis

Note: w.b. = wet basis, d.b. = dry basis

Bag Contents

Combined Pan & Sample Weight (w.b.), g _____

Weighing Pan Tare Weight, g _____

Sample Weight (w.b.), g 0.0

Combined Pan & Sample Weight (d.b.), g _____

Sample Weight (d.b.), g 0.0

[redacted] W_i

W_f

Percent Moisture Content % #DIV/0!

$$\%M = \frac{W_i - W_f}{W_i} * 100$$

Balance properly zeroed and calibrated: _____ Date

Filter Bag

Bag & Pouch Tare Weight, g _____

Bag, Pouch & Sample Wt, (w.b.), g _____

Bag, Pouch & Silt Wt., brushed (w.b.), g _____

Silt Weight, (w.b.), g 0

Dried Bag, Pouch & Silt Wt. (d.b.), g _____

Silt Weight, (d.b.), g 0

II. Particle Sizing Analysis and Silt Loading

Shaker Run Number	Elapsed Time (min)	Collection Pan, Silt Weight, (%)	Pan Tare Weight	Pan Net	Change in Silt Weight, (%)
1			0.0	0	ZERO %
2			0.0	0	#DIV/0!
3			0.0	0	#DIV/0!
4			0.0	0	#DIV/0!

$$\Delta W = \frac{(W_{(i-1)} - W_{(i)})}{W_{(i-1)}} * 100$$

	No. 20 Sieve (g)	No. 200 Sieve (g)	Pan (g)
Final Weight, (g)			
Tare Weight, (g)			
Net Weight, (g)	0	0	0
Wt. Fraction, %	#DIV/0!	#DIV/0!	#DIV/0!

Total Silt, (g) = Filter Silt + Pan Silt

Total Silt, (g) = 0

Area Swept, m^2 0.00

Silt Loading, g/m^2 #DIV/0!

Silt Fraction, % #DIV/0!

SAMPLE MASS COMPARISION

Dry sample weight	0.0
Sized sample weight	0.0
Net Difference	0.0

Max allowable limit is 2% difference,
or for this particular sample:
0 gms.

SAMPLING DATA FROM PAVED ROADS

(Sample in accordance with AP-42, Appendix C.1.2)

Data Sample Collected 8/5/97 **Sample Bag Identification Number** D-034

Sampling Location
(e.g., Maple between 3rd and 4th Street) Hwy 70
Garner

Road area zip code

Road description:

1. Number of lanes 4 Lane width Posted traffic speed 45
2. Surface type (e.g., asphalt, concrete): asphalt
3. Surface conditions (e.g., smooth, weathered): weathered and smooth
4. Vehicle types (e.g., cars, trucks): all
5. Estimated daily vehicle traffic load (information available at local DOT): 28,200
   a. Measured or estimated?
6. Description of neighborhood (agricultural, residential, commercial, industrial: commercial, residential
7. Are there construction sites within 0.5 miles, or unpaved road accesses other than residential driveways that would contribute to silt loading? If so, describe the severity of track-out and distance from sample location.
   No
8. Describe surrounding soil type (e.g., loam, sand, clay...) loam
9. Weather Related Information:
   a. Has it rained in the past 48 hours? (Yes/No) Yes
   b. Has winter weather traction material been spread on the road in the past 30 days (Yes/No) No
   c. If so, what type of material (e.g., sand, salt, slag)
   d. How heavily was it spread? (lbs/mile/lane)
10. Weather conditions (over the past 24 hours)(e.d., sunny, windy): sunny, windy, rainy

11. **Road Sample** surface dimensions for this sample

Sample Area		Length (ft)		Width (ft)		Area (m^2)
1		51.75		11.67		56.1044003
2		51.17		11.67		55.4755973
3		51.5		10.67		51.0490145
4		51.67		10.67		51.2175258

Note: The computer will calculate the area. Report 5'-6" as 5.5 ft.

Total Area 213.85 m^2

12. ***Curb Sample:*** Road edge description (e.g., curbed, ditch): curbed - only on 'r' and ditch (r/l), small shoulder on lef

a. Was a curb sample taken (Yes/No) Yes b. If so, **Sample Bag Identification Num.** BAG No. D-035

Surface dimensions for this sample. (Use a broom to collect any large debris and vacuum area from curb-side white line to curb. If no curb exists, collect the sample from the curb-side white line on hard paved shoulder surface to the beginning of grass or ditch.)

Sample Area		Length (ft)		Width (ft)		Area (m^2)
1		51.75		3.5		16.8265125
2		51.17		3.5		16.6379255
3		51.5		0.75		3.5882625
4		51.67		0.75		3.60010725

Note: The computer will calculate the area. Report 5'-6" as 5.5 ft.

Total Area 40.65 m^2

13. Sample Collection Team:

Sample Collection Team Members (Last names): Gatewood, Okabayashi, White

Organization Collecting Samples: PES

Organization Telephone Number: (919) 941-0333

Road Silt Analysis Data Sheet

Analysis Date: 8/11/97 | Bag ID No.: D-034

Collection Location: Hwy 70 | Analyst: Frederici

Comments: Garner

I. Moisture Analysis

Note: w.b. = wet basis, d.b. = dry basis

Balance properly zeroed and calibrated: 8/11/97 (Date)

Bag Contents		Filter Bag	
Pan & Sample Weight (w.b.), g	289.6	Bag & Pouch Tare Weight, g	92.4
Weighing Pan Tare Weight, g	218.7	Bag, Pouch & Sample Wt, (w.b.), g	184.5
Sample Weight (w.b.), g	70.9	Bag, Pouch & Silt Wt., brushed (w.b.), g	113.3
Pan & Sample Weight (d.b.), g	289.1	Silt Weight, (w.b.), g	20.9
Sample Weight (d.b.), g	70.4	Dried Bag, Pouch & Silt Wt. (d.b.), g	111.4
[redacted]	W_i	Silt Weight, (d.b.), g	19
[redacted]	W_f		

Percent Moisture Content, %M= 2.61%

$$\%M = \frac{W_i - W_f}{W_i} * 100$$

II. Particle Sizing Analysis and Silt Loading

Shaker Run Number	Elapsed Time (min)	Collection Pan & Silt Weight	Pan Tare Weight	Net	Change in Silt Weight, (%)
1 5	10	527.8	499.9	27.9	ZERO %
2 5	10	528.2	499.9	28.3	1.41%
3			499.9	-500	105.66%
4			499.9	-500	0.00%

$$\Delta W = \frac{(W_{(i-1)} - W_{(i)})}{W_{(i-1)}} * 100$$

	No. 20 Sieve (g)	No. 200 Sieve (g)	Pan (g)
Final Weight, (g)	385.9	342.5	528.2
Tare Weight, (g)	382.1	304.8	499.9
Net Weight, (g)	3.8	37.7	28.3
Wt. Fraction, %	4.25%	42.17%	31.66%

Total Silt, (g) = Filter Silt + Pan Silt

Total Silt, (g) = 47.3

Area Swept, m^2 213.85

Silt Loading, g/m^2 2.21E-01

Silt Fraction, % 0.67765

SAMPLE MASS COMPARISION

Dry sample weight	89.4
Sized sample weight	88.8
Net Difference	0.6

Max allowable limit is 2% difference, or for this particular sample: 1.788 gms.

Curb Silt Analysis Data Sheet

Analysis Date: 8/11/97 | Bag ID No.: D-035

Collection Location: Hwy 70 - Garner | Analyst: Frederici

Comments: Note: Curb area sample (right side)

Note: Curb area sample (left side - ditch)

I. Moisture Analysis

Note: w.b. = wet basis, d.b. = dry basis

Balance properly zeroed and calibrated: 8/11/97 (Date)

Bag Contents		Filter Bag	
Combined Pan & Sample Weight (w.	399.3	Bag & Pouch Tare Weight, g	92.5
Weighing Pan Tare Weight, g	211.3	Bag, Pouch & Sample Wt, (w.b.), g	301.9
Sample Weight (w.b.), g	188.0	Bag, Pouch & Silt Wt., brushed (w.b.), g	113.2
Combined Pan & Sample Weight (d.	398.5	Silt Weight, (w.b.), g	20.7
Sample Weight (d.b.), g	187.2	Dried Bag, Pouch & Silt Wt. (d.b.), g	111.2
[redacted]	W_i	Silt Weight, (d.b.), g	18.7
[redacted]	W_f		

Percent Moisture Content % 1.34%

$$\%M = \frac{W_i - W_f}{W_i} * 100$$

II. Particle Sizing Analysis and Silt Loading

Shaker Run Number	Elapsed Time (min)	Collection Pan, Silt Weight, (%)	Pan Tare Weight	Pan Net	Change in Silt Weight, (%)
1 5	10	549.2	499.6	49.6	ZERO %
2 5	10	550.4	499.6	50.8	2.36%
3			499.6	-499.6	110.17%
4			499.6	-499.6	0.00%

$$\Delta W = \frac{(W_{(i-1)} - W_{(i)})}{W_{(i-1)}} * 100$$

Total Silt, (g) = Filter Silt + Pan Silt

Total Silt, (g) = 69.5

	No. 20 Sieve (g)	No. 200 Sieve (g)	Pan (g)
Final Weight, (g)	414	409.5	550.4
Tare Weight, (g)	382	304.6	499.6
Net Weight, (g)	32	104.9	50.8
Wt. Fraction, %	15.54%	50.95%	24.67%

Area Swept, m^2 40.65

Silt Loading, g/m^2 1.71E+00

Silt Fraction, % 0.398509

SAMPLE MASS COMPARISION

Dry sample weight	205.9
Sized sample weight	206.4
Net Difference	-0.5

Max allowable limit is 2% difference, or for this particular sample: 4.118 gms.

SAMPLING DATA FROM PAVED ROADS

(Sample in accordance with AP-42, Appendix C.1.2)

Data Sample Collected 8/6/97 **Sample Bag Identification Number** D-038

Sampling Location
(e.g., Maple between 3rd and 4th Street) 401 After split from 70

Road area zip code _____

Road description:

1. Number of lanes 4 Lane width _____ Posted traffic speed 55
2. Surface type (e.g., asphalt, concrete): asphalt
3. Surface conditions (e.g., smooth, weathered): smooth w/ cracks on surface
4. Vehicle types (e.g., cars, trucks): all
5. Estimated daily vehicle traffic load (information available at local DOT): 25,300
   a. Measured or estimated? _____
6. Description of neighborhood (agricultural, residential, commercial, industrial: residential
7. Are there construction sites within 0.5 miles, or unpaved road accesses other than residential driveways that would contribute to silt loading? If so, describe the severity of track-out and distance from sample location.
   No
8. Describe surrounding soil type (e.g., loam, sand, clay...) clay
9. Weather Related Information:
   a. Has it rained in the past 48 hours? (Yes/No) Yes
   b. Has winter weather traction material been spread on the road in the past 30 days (Yes/No) No
   c. If so, what type of material (e.g., sand, salt, slag) _____
   d. How heavily was it spread? (lbs/mile/lane) _____
10. Weather conditions (over the past 24 hours)(e.d., sunny, windy): rainy, sunny, hot

11. **Road Sample** surface dimensions for this sample

Sample Area		Length (ft)		Width (ft)		Area (m^2)
1		52.1		11.67		56.4838503
2		52		11.83		57.148364
3		51.83		10.75		51.7613253
4		51.83		10.75		51.7613253

Note: The computer will calculate the area. Report 5'-6" as 5.5 ft.

Total Area 217.15 m^2

12. **Curb Sample:** Road edge description (e.g., curbed, ditch): shoulder (r), ditch on (l)

a. Was a curb sample taken (Yes/No) Yes b. If so, **Sample Bag Identification Num.**
BAG No. D-039

Surface dimensions for this sample. (Use a broom to collect any large debris and vacuum area from curb-side white line to curb. If no curb exists, collect the sample from the curb-side white line on hard paved shoulder surface to the beginning of grass or ditch.)

Sample Area		Length (ft)		Width (ft)		Area (m^2)
1		52.1		3.67		17.7631303
2		52		3.33		16.086564
3						0
4						0

Note: The computer will calculate the area. Report 5'-6" as 5.5 ft.

Total Area 33.85 m^2

13. Sample Collection Team:

Sample Collection Team Members (Last names): Mullen, Okabayashi, Gatewood

Organization Collecting Samples: PES

Organization Telephone Number: (919) 941-0333

Road Silt Analysis Data Sheet

Analysis Date: 8/12/97 **Bag ID No.:** D-038

Collection Location: Hwy 401 Analyst: Frederici

Comments: After split from Hwy 70

I. Moisture Analysis

Note: w.b. = wet basis, d.b. = dry basis

Balance properly zeroed and calibrated: 8/12/97 (Date)

Bag Contents		Filter Bag	
Pan & Sample Weight (w.b.), g	318.4	Bag & Pouch Tare Weight, g	91.9
Weighing Pan Tare Weight, g	218.0	Bag, Pouch & Sample Wt, (w.b.), g	202.8
Sample Weight (w.b.), g	100.4	Bag, Pouch & Silt Wt., brushed (w.b.), g	102.4
Pan & Sample Weight (d.b.), g	318.2	Silt Weight, (w.b.), g	10.5
Sample Weight (d.b.), g	100.2	Dried Bag, Pouch & Silt Wt. (d.b.), g	101
[redacted]	W_i	Silt Weight, (d.b.), g	9.1
[redacted]	W_f		

Percent Moisture Content, %M= 1.44%

$$\%M = \frac{W_i - W_f}{W_i} * 100$$

II. Particle Sizing Analysis and Silt Loading

Shaker Run Number	Elapsed Time (min)	Collection Pan & Silt Weight	Pan Tare Weight	Net	Change in Silt Weight, (%)
1 5	10	513	499.9	13.1	ZERO %
2 5	10	513.9	499.9	14	6.43%
3 5	10	514.2	499.9	14.3	2.10%
4			499.9	-500	102.86%

$$\Delta W = \frac{(W_{(i-1)} - W_{(i)})}{W_{(i-1)}} * 100$$

	No. 20 Sieve (g)	No. 200 Sieve (g)	Pan (g)
Final Weight, (g)	397.3	375.8	514.2
Tare Weight, (g)	382.4	304.9	499.9
Net Weight, (g)	14.9	70.9	14.3
Wt. Fraction, %	13.63%	64.87%	13.08%

Total Silt, (g) = Filter Silt + Pan Silt

Total Silt, (g) = 23.4

Area Swept, m^2 217.15

Silt Loading, g/m^2 1.08E-01

Silt Fraction, % 0.233766

SAMPLE MASS COMPARISION

Dry sample weight	109.3
Sized sample weight	109.2
Net Difference	0.1

Max allowable limit is 2% difference, or for this particular sample: 2.186 gms.

Curb Silt Analysis Data Sheet

Analysis Date: 8/12/97 | Bag ID No.: D-039

Collection Location: Hwy 401 | Analyst: Frederici

Comments: After split from Hwy 70

Note: Shoulder - right/ Ditch - left

I. Moisture Analysis

Note: w.b. = wet basis, d.b. = dry basis

Balance properly zeroed and calibrated: 8/12/97 (Date)

Bag Contents		Filter Bag	
Combined Pan & Sample Weight (w.	470.3	Bag & Pouch Tare Weight, g	92.8
Weighing Pan Tare Weight, g	222.7	Bag, Pouch & Sample Wt, (w.b.), g	348.1
Sample Weight (w.b.), g	247.6	Bag, Pouch & Silt Wt., brushed (w.b.), g	100.3
Combined Pan & Sample Weight (d.	470.2	Silt Weight, (w.b.), g	7.5
Sample Weight (d.b.), g	247.5	Dried Bag, Pouch & Silt Wt. (d.b.), g	98.7
[redacted]	W_i	Silt Weight, (d.b.), g	5.9
[redacted]	W_f		

Percent Moisture Content % 0.67%

$$\%M = \frac{W_i - W_f}{W_i} * 100$$

II. Particle Sizing Analysis and Silt Loading

Shaker Run Number	Elapsed Time (min)	Collection Pan, Silt Weight, (%)	Pan Tare Weight	Pan Net	Change in Silt Weight, (%)
1 5	10	512.2	499.6	12.6	ZERO %
2 5	10	513.6	499.6	14	10.00%
3 5	10	514.1	499.6	14.5	3.45%
4 5	10	514.3	499.6	14.7	1.36%

$$\Delta W = \frac{(W_{(i-1)} - W_{(i)})}{W_{(i-1)}} * 100$$

	No. 20 Sieve (g)	No. 200 Sieve (g)	Pan (g)
Final Weight, (g)	429.6	490.1	514.3
Tare Weight, (g)	382.2	304.6	499.6
Net Weight, (g)	47.4	185.5	14.7
Wt. Fraction, %	18.71%	73.20%	5.80%

Total Silt, (g) = Filter Silt + Pan Silt

Total Silt, (g) = 20.6

Area Swept, m^2 33.85

Silt Loading, g/m^2 6.09E-01

Silt Fraction, % 0.099951

SAMPLE MASS COMPARISION

Dry sample weight	253.4
Sized sample weight	253.5
Net Difference	-0.1

Max allowable limit is 2% difference, or for this particular sample: 5.068 gms.

SAMPLING DATA FROM PAVED ROADS

(Sample in accordance with AP-42, Appendix C.1.2)

Data Sample Collected 7/28/97 **Sample Bag Identification Number** D-022

Sampling Location
(e.g., Maple between 3rd and 4th Street) Hwy 54 = Maynard before Northwoods Drive

Road area zip code _____

Road description:

1. Number of lanes 4 Lane width _____ Posted traffic speed 45
2. Surface type (e.g., asphalt, concrete): asphalt
3. Surface conditions (e.g., smooth, weathered): smooth
4. Vehicle types (e.g., cars, trucks): both
5. Estimated daily vehicle traffic load (information available at local DOT): 13,300
   a. Measured or estimated? _____
6. Description of neighborhood (agricultural, residential, commercial, industrial: commercial
7. Are there construction sites within 0.5 miles, or unpaved road accesses other than residential driveways that would contribute to silt loading? If so, describe the severity of track-out and distance from sample location.
   No
8. Describe surrounding soil type (e.g., loam, sand, clay...) clay
9. Weather Related Information:
   a. Has it rained in the past 48 hours? (Yes/No) No
   b. Has winter weather traction material been spread on the road in the past 30 days (Yes/No) No
   c. If so, what type of material (e.g., sand, salt, slag) _____
   d. How heavily was it spread? (lbs/mile/lane) _____
10. Weather conditions (over the past 24 hours)(e.d., sunny, windy): hot, sunny

11. **Road Sample** surface dimensions for this sample

Sample Area		Length (ft)		Width (ft)		Area (m^2)
1		50.25		12.83		59.8933268
2		50.25		12.33		57.5592143
3		49		10		45.521
4		49.75		10.83		50.0538233

Note: The computer will calculate the area. Report 5'-6" as 5.5 ft.

Total Area 213.03 m^2

12. **Curb Sample:** Road edge description (e.g., curbed, ditch): curbed (r), no curb or shoulder (l)

a. Was a curb sample taken (Yes/No) Yes b. If so, **Sample Bag Identification Num.** BAG No. D-023

Surface dimensions for this sample. (Use a broom to collect any large debris and vacuum area from curb-side white line to curb. If no curb exists, collect the sample from the curb-side white line on hard paved shoulder surface to the beginning of grass or ditch.)

Sample Area		Length (ft)		Width (ft)		Area (m^2)
1		50.25		1.83		8.54285175
2		50.25		1.83		8.54285175
3						0
4						0

Note: The computer will calculate the area. Report 5'-6" as 5.5 ft.

Total Area 17.09 m^2

13. Sample Collection Team:

Sample Collection Team Members (Last names): Okabayashi, Gatewood, White

Organization Collecting Samples: PES

Organization Telephone Number: (919) 941-0333

Road Silt Analysis Data Sheet

Analysis Date: 8/6/97 | Bag ID No.: D-022

Collection Location: Hwy 54 = Maynard | Analyst:

Comments: Before Northwoods Drive

I. Moisture Analysis

Note: w.b. = wet basis, d.b. = dry basis

Balance properly zeroed and calibrated: 8/6/97 (Date)

Bag Contents		Filter Bag	
Pan & Sample Weight (w.b.), g	317.8	Bag & Pouch Tare Weight, g	75.9
Weighing Pan Tare Weight, g	222.3	Bag, Pouch & Sample Wt, (w.b.), g	178.3
Sample Weight (w.b.), g	95.5	Bag, Pouch & Silt Wt., brushed (w.b.), g	82.5
Pan & Sample Weight (d.b.), g	318.0	Silt Weight, (w.b.), g	6.6
Sample Weight (d.b.), g	95.7	Dried Bag, Pouch & Silt Wt. (d.b.), g	79.7
[redacted]	W_i	Silt Weight, (d.b.), g	3.8
[redacted]	W_f		

Percent Moisture Content, %M= 2.55%

$$\%M = \frac{W_i - W_f}{W_i} * 100$$

II. Particle Sizing Analysis and Silt Loading

Shaker Run Number		Elapsed Time (min)	Collection Pan & Silt Weight	Pan Tare Weight	Pan Net	Change in Silt Weight, (%)
1	5	10	512.2	499.7	12.5	ZERO %
2	5	10	512.9	499.7	13.2	5.30%
3	5	10	513.1	499.7	13.4	1.49%
4				499.7	-500	102.68%

$$\Delta W = \frac{(W_{(i-1)} - W_{(i)})}{W_{(i-1)}} * 100$$

Total Silt, (g) = Filter Silt + Pan Silt

Total Silt, (g) = 17.2

	No. 20 Sieve (g)	No. 200 Sieve (g)	Pan (g)
Final Weight, (g)	410.2	359	513.1
Tare Weight, (g)	382.1	304.8	499.7
Net Weight, (g)	28.1	54.2	13.4
Wt. Fraction, %	28.24%	54.47%	13.47%

Area Swept, m^2 213.03

Silt Loading, g/m^2 8.07E-02

Silt Fraction, % 0.179728

SAMPLE MASS COMPARISION

Dry sample weight	99.5
Sized sample weight	99.5
Net Difference	0.0

Max allowable limit is 2% difference, or for this particular sample: 1.99 gms.

Curb Silt Analysis Data Sheet

Analysis Date: 8/6/97 | Bag ID No.: D-023

Collection Location: Hwy 54 = Maynard | Analyst: Frederici

Comments: Before Northwoods Drive

Note: Curb Sample Area

I. Moisture Analysis

Note: w.b. = wet basis, d.b. = dry basis

Balance properly zeroed and calibrated: 8/6/97 (Date)

Bag Contents		Filter Bag	
Combined Pan & Sample Weight (w.	349.7	Bag & Pouch Tare Weight, g	76
Weighing Pan Tare Weight, g	217.8	Bag, Pouch & Sample Wt, (w.b.), g	214
Sample Weight (w.b.), g	131.9	Bag, Pouch & Silt Wt., brushed (w.b.), g	81.7
Combined Pan & Sample Weight (d.	349.8	Silt Weight, (w.b.), g	5.7
Sample Weight (d.b.), g	132.0	Dried Bag, Pouch & Silt Wt. (d.b.), g	78.8
[redacted]	W_i	Silt Weight, (d.b.), g	2.8
[redacted]	W_f		

Percent Moisture Content % 2.03%

$$\%M = \frac{W_i - W_f}{W_i} * 100$$

II. Particle Sizing Analysis and Silt Loading

Shaker Run Number	Elapsed Time (min)	Collection Pan, Silt Weight, (%)	Pan Tare Weight	Pan Net	Change in Silt Weight, (%)
1 5	10	513.3	499.9	13.4	ZERO %
2 5	10	514	499.9	14.1	4.96%
3 5	10	514.4	499.9	14.5	2.76%
4			499.9	-499.9	102.90%

$$\Delta W = \frac{(W_{(i-1)} - W_{(i)})}{W_{(i-1)}} * 100$$

	No. 20 Sieve (g)	No. 200 Sieve (g)	Pan (g)
Final Weight, (g)	424.5	378.9	514.4
Tare Weight, (g)	382.2	304.9	499.9
Net Weight, (g)	42.3	74	14.5
Wt. Fraction, %	31.38%	54.90%	10.76%

Total Silt, (g) = Filter Silt + Pan Silt

Total Silt, (g) = 17.3

Area Swept, m^2 17.09

Silt Loading, g/m^2 1.01E+00

Silt Fraction, % 0.189485

SAMPLE MASS COMPARISION

Dry sample weight	134.8
Sized sample weight	133.6
Net Difference	1.2

Max allowable limit is 2% difference, or for this particular sample: 2.696 gms.

SAMPLING DATA FROM PAVED ROADS

(Sample in accordance with AP-42, Appendix C.1.2)

Data Sample Collected 7/22/97 **Sample Bag Identification Number** D-016

Sampling Location
(e.g., Maple between 3rd and 4th Street) Hwy 55 between Cornwallis & Riddle

Road area zip code _____

Road description:

1. Number of lanes 4 Lane width _____ Posted traffic speed 55 mph
2. Surface type (e.g., asphalt, concrete): asphalt
3. Surface conditions (e.g., smooth, weathered): smooth
4. Vehicle types (e.g., cars, trucks): both
5. Estimated daily vehicle traffic load (information available at local DOT): 12,000
   a. Measured or estimated? _____
6. Description of neighborhood (agricultural, residential, commercial, industrial: heteogeneous
7. Are there construction sites within 0.5 miles, or unpaved road accesses other than residential driveways that would contribute to silt loading? If so, describe the severity of track-out and distance from sample location.
   1 construction site on opposite side of road.
   Limited trackout b/c site appears nonoperational
8. Describe surrounding soil type (e.g., loam, sand, clay...) loam
9. Weather Related Information:
   a. Has it rained in the past 48 hours? (Yes/No) No
   b. Has winter weather traction material been spread on the road in the past 30 days (Yes/No) No
   c. If so, what type of material (e.g., sand, salt, slag) _____
   d. How heavily was it spread? (lbs/mile/lane) _____
10. Weather conditions (over the past 24 hours)(e.d., sunny, windy): partly cloudy - sunny

11. **Road Sample** surface dimensions for this sample

Sample Area		Length (ft)		Width (ft)		Area (m^2)
1		50		10.67		49.56215
2		50		10.57		49.09765
3		50		10.42		48.4009
4		50		10.16		47.1932

Note: The computer will calculate the area. Report 5'-6" as 5.5 ft.

Total Area 194.25 m^2

12. **Curb Sample:** Road edge description (e.g., curbed, ditch): paved shoulder with ditch

a. Was a curb sample taken (Yes/No) _____ b. If so, **Sample Bag Identification Num.**
BAG No. D-017

Surface dimensions for this sample. (Use a broom to collect any large debris and vacuum area from curb-side white line to curb. If no curb exists, collect the sample from the curb-side white line on hard paved shoulder surface to the beginning of *grass or ditch.)*

Sample Area		Length (ft)		Width (ft)		Area (m^2)
1		50		0.83		3.85535
2		50		0.83		3.85535
3		50		0.75		3.48375
4		50		0.67		3.11215

Note: The computer will calculate the area. Report 5'-6" as 5.5 ft.

Total Area 14.31 m^2

13. Sample Collection Team:

Sample Collection Team Members (Last names): Mullen, Okabayashi

Organization Collecting Samples: PES

Organization Telephone Number: (919) 941-0333

Road Silt Analysis Data Sheet

Analysis Date: 8/5/97 | Bag ID No.: D-016

Collection Location: Hwy 55 between | Analyst: Frederici

Comments: Cornwallis & Riddle

I. Moisture Analysis

Note: w.b. = wet basis, d.b. = dry basis

Balance properly zeroed and calibrated: 8/5/97 (Date)

Bag Contents		Filter Bag	
Pan & Sample Weight (w.b.), g	325.4	Bag & Pouch Tare Weight, g	70.5
Weighing Pan Tare Weight, g	293.5	Bag, Pouch & Sample Wt, (w.b.), g	107.1
Sample Weight (w.b.), g	31.9	Bag, Pouch & Silt Wt., brushed (w.b.), g	74.9
Pan & Sample Weight (d.b.), g	325.3	Silt Weight, (w.b.), g	4.4
Sample Weight (d.b.), g	31.8	Dried Bag, Pouch & Silt Wt. (d.b.), g	72.1
[redacted]	W_i	Silt Weight, (d.b.), g	1.6
	W_f		

Percent Moisture Content, %M= 7.99%

$$\%M = \frac{W_i - W_f}{W_i} * 100$$

II. Particle Sizing Analysis and Silt Loading

Shaker Run Number	Elapsed Time (min)	Collection Pan & Silt Weight	Pan Tare Weight	Net	Change in Silt Weight, (%)
1 5	10	502.5	499.8	2.7	ZERO %
2 5	10	503	499.8	3.2	15.63%
3 5	10	503.1	499.8	3.3	3.03%
4 5	10	503.1	499.8	3.3	0.00%

$$\Delta W = \frac{(W_{(i-1)} - W_{(i)})}{W_{(i-1)}} * 100$$

	No. 20 Sieve (g)	No. 200 Sieve (g)	Pan (g)
Final Weight, (g)	390.5	325.6	503.1
Tare Weight, (g)	382.7	304.8	499.8
Net Weight, (g)	7.8	20.8	3.3
Wt. Fraction, %	23.35%	62.28%	9.88%

Total Silt, (g) = Filter Silt + Pan Silt

Total Silt, (g) = 4.9

Area Swept, m^2 194.25

Silt Loading, g/m^2 2.52E-02

Silt Fraction, % 0.153605

SAMPLE MASS COMPARISION

Dry sample weight	33.4
Sized sample weight	33.5
Net Difference	-0.1

Max allowable limit is 2% difference, or for this particular sample: 0.668 gms.

Curb Silt Analysis Data Sheet

Analysis Date: 8/5/97 | Bag ID No.: D-017

Collection Location: Hwy 55 between | Analyst: Frederici

Comments: Cornwallis & Riddle Road

Note: Curb Sample Area

I. Moisture Analysis

Note: w.b. = wet basis, d.b. = dry basis

Balance properly zeroed and calibrated: 8/5/97 (Date)

Bag Contents		Filter Bag	
Combined Pan & Sample Weight (w.	337.2	Bag & Pouch Tare Weight, g	70.5
Weighing Pan Tare Weight, g	293.5	Bag, Pouch & Sample Wt, (w.b.), g	118.6
Sample Weight (w.b.), g	43.7	Bag, Pouch & Silt Wt., brushed (w.b.), g	74
Combined Pan & Sample Weight (d.	337.0	Silt Weight, (w.b.), g	3.5
Sample Weight (d.b.), g	43.5	Dried Bag, Pouch & Silt Wt. (d.b.), g	71.7
[redacted]	W_i	Silt Weight, (d.b.), g	1.2
[redacted]	W_f		

Percent Moisture Content % 5.30%

$$\%M = \frac{W_i - W_f}{W_i} * 100$$

II. Particle Sizing Analysis and Silt Loading

Shaker Run Number	Elapsed Time (min)	Collection Pan, Silt Weight, (%)	Pan Tare Weight	Pan Net	Change in Silt Weight, (%)
1 5	10	501.4	499.8	1.6	ZERO %
2 5	10	501.6	499.8	1.8	11.11%
3 5	10	501.7	499.8	1.9	5.26%
4 5	10	501.8	499.8	2	5.00%

$$\Delta W = \frac{(W_{(i-1)} - W_{(i)})}{W_{(i-1)}} * 100$$

	No. 20 Sieve (g)	No. 200 Sieve (g)	Pan (g)
Final Weight, (g)	397.3	330.3	501.8
Tare Weight, (g)	382.3	304.2	499.8
Net Weight, (g)	15	26.1	2
Wt. Fraction, %	33.56%	58.39%	4.47%

Total Silt, (g) = Filter Silt + Pan Silt

Total Silt, (g) = 3.2

Area Swept, m^2 14.31

Silt Loading, g/m^2 2.24E-01

Silt Fraction, % 0.109215

SAMPLE MASS COMPARISION

Dry sample weight	44.7
Sized sample weight	44.3
Net Difference	0.4

Max allowable limit is 2% difference, or for this particular sample: 0.894 gms.

SAMPLING DATA FROM PAVED ROADS

(Sample in accordance with AP-42, Appendix C.1.2)

Data Sample Collected 7/23/97 **Sample Bag Identification Number** D-033

Sampling Location
(e.g., Maple between 3rd and 4th Street) Hwy 64
Between King William Road
& Wake Medical Center

Road area zip code _____

Road description:

1. Number of lanes 4 Lane width _____ Posted traffic speed 45
2. Surface type (e.g., asphalt, concrete): asphalt
3. Surface conditions (e.g., smooth, weathered): smooth
4. Vehicle types (e.g., cars, trucks): all
5. Estimated daily vehicle traffic load (information available at local DOT): 25,900
   a. Measured or estimated? _____
6. Description of neighborhood (agricultural, residential, commercial, industrial: all
7. Are there construction sites within 0.5 miles, or unpaved road accesses other than residential driveways that would contribute to silt loading? If so, describe the severity of track-out and distance from sample location.
   No
8. Describe surrounding soil type (e.g., loam, sand, clay...) loam
9. Weather Related Information:
   a. Has it rained in the past 48 hours? (Yes/No) Yes
   b. Has winter weather traction material been spread on the road in the past 30 days (Yes/No) No
   c. If so, what type of material (e.g., sand, salt, slag) _____
   d. How heavily was it spread? (lbs/mile/lane) _____
10. Weather conditions (over the past 24 hours)(e.d., sunny, windy): sunny, cloudy

11. **Road Sample** surface dimensions for this sample

Sample Area		Length (ft)		Width (ft)		Area (m^2)
1		50.25		10.42		48.6429045
2		51		10.5		49.74795
3		50		10.17		47.23965
4		51		10.42		49.368918

Note: The computer will calculate the area. Report 5'-6" as 5.5 ft.

Total Area 195.00 m^2

12. **Curb Sample:** Road edge description (e.g., curbed, ditch): ditch on both sides, "low shoulder" signs

a. Was a curb sample taken (Yes/No) No b. If so, **Sample Bag Identification Num.** BAG No. None

Surface dimensions for this sample. (Use a broom to collect any large debris and vacuum area from curb-side white line to curb. *If no curb exists*, collect the sample from the curb-side white line on hard paved shoulder surface to the beginning of grass or ditch.)

Sample Area		Length (ft)		Width (ft)		Area (m^2)
1						0
2						0
3						0
4						0

Note: The computer will calculate the area. Report 5'-6" as 5.5 ft.

Total Area 0.00 m^2

13. Sample Collection Team:

Sample Collection Team Members (Last names) _____ _____ _____ _____

Organization Collecting Samples _____

Organization Telephone Number _____

Road Silt Analysis Data Sheet

Analysis Date: 8/11/97 | Bag ID No.: D-033

Collection Location: Hwy 64 | Analyst: Frederici

Comments: Between King Williams Road & Wake Medical Center

I. Moisture Analysis

Balance properly zeroed and calibrated: 8/11/97 (Date)

Note: w.b. = wet basis, d.b. = dry basis

Bag Contents		Filter Bag	
Pan & Sample Weight (w.b.), g	258.0	Bag & Pouch Tare Weight, g	92.1
Weighing Pan Tare Weight, g	222.8	Bag, Pouch & Sample Wt, (w.b.), g	134.4
Sample Weight (w.b.), g	35.2	Bag, Pouch & Silt Wt., brushed (w.b.), g	99.3
Pan & Sample Weight (d.b.), g	257.9	Silt Weight, (w.b.), g	7.2
Sample Weight (d.b.), g	35.1	Dried Bag, Pouch & Silt Wt. (d.b.), g	97.7
[redacted]	W_i	Silt Weight, (d.b.), g	5.6
[redacted]	W_f		

Percent Moisture Content, %M= 4.01%

$$\%M = \frac{W_i - W_f}{W_i} * 100$$

II. Particle Sizing Analysis and Silt Loading

Shaker Run Number	Elapsed Time (min)	Collection Pan & Silt Weight	Pan Tare Weight	Pan Net	Change in Silt Weight, (%)
1 5	10	504.8	499.7	5.1	ZERO %
2 5	10	505.1	499.7	5.4	5.56%
3 5	10	505.2	499.7	5.5	1.82%
4			499.7	-500	101.10%

$$\Delta W = \frac{(W_{(i-1)} - W_{(i)})}{W_{(i-1)}} * 100$$

Total Silt, (g) = Filter Silt + Pan Silt

Total Silt, (g) = 11.1

	No. 20 Sieve (g)	No. 200 Sieve (g)	Pan (g)
Final Weight, (g)	384.2	332.5	505.2
Tare Weight, (g)	382.1	304.6	499.7
Net Weight, (g)	2.1	27.9	5.5
Wt. Fraction, %	5.16%	68.55%	13.51%

Area Swept, m^2 195.00

Silt Loading, g/m^2 5.69E-02

Silt Fraction, % 0.312676

SAMPLE MASS COMPARISION

Dry sample weight	40.7
Sized sample weight	41.1
Net Difference	-0.4

Max allowable limit is 2% difference, or for this particular sample: 0.814 gms.

Curb Silt Analysis Data Sheet

Analysis Date: _____ Bag ID No.: None

Collection Location: _____ Analyst: _____

Comments: _____

I. Moisture Analysis

Balance properly zeroed and calibrated: _____ Date

Note: w.b. = wet basis, d.b. = dry basis

Bag Contents		Filter Bag	
Combined Pan & Sample Weight (w.b.), g		Bag & Pouch Tare Weight, g	
Weighing Pan Tare Weight, g		Bag, Pouch & Sample Wt, (w.b.), g	
Sample Weight (w.b.), g	0.0	Bag, Pouch & Silt Wt., brushed (w.b.), g	
Combined Pan & Sample Weight (d.b.), g		Silt Weight, (w.b.), g	0
Sample Weight (d.b.), g	0.0	Dried Bag, Pouch & Silt Wt. (d.b.), g	
[illegible]	0.0 W_i	Silt Weight, (d.b.), g	0
[illegible]	0.0 W_f		

Percent Moisture Content % #DIV/0!

$$\%M = \frac{W_i - W_f}{W_i} * 100$$

II. Particle Sizing Analysis and Silt Loading

Shaker Run Number	Elapsed Time (min)	Collection Pan, Silt Weight, (%)	Pan Tare Weight	Pan Net	Change in Silt Weight, (%)
1			0.0	0	ZERO %
2			0.0	0	#DIV/0!
3			0.0	0	#DIV/0!
4			0.0	0	#DIV/0!

$$\Delta W = \frac{(W_{(i-1)} - W_{(i)})}{W_{(i-1)}} * 100$$

Total Silt, (g) = Filter Silt + Pan Silt

Total Silt, (g) = 0

	No. 20 Sieve (g)	No. 200 Sieve (g)	Pan (g)
Final Weight, (g)			
Tare Weight, (g)			
Net Weight, (g)	0	0	0
Wt. Fraction, %	#DIV/0!	#DIV/0!	#DIV/0!

Area Swept, m^2 0.00

Silt Loading, g/m^2 #DIV/0!

Silt Fraction, % #DIV/0!

SAMPLE MASS COMPARISION

Dry sample weight	0.0
Sized sample weight	0.0
Net Difference	0.0

Max allowable limit is 2% difference, or for this particular sample: 0 gms.

SAMPLING DATA FROM PAVED ROADS

(Sample in accordance with AP-42, Appendix C.1.2)

Data Sample Collected 7/23/97 **Sample Bag Identification Number** D-020

Sampling Location
(e.g., Maple between 3rd and 4th Street) Evans, St. Road 3048
between Aviation & Hwy 54

Road area zip code

Road description:

1. Number of lanes 4 Lane width Posted traffic speed 45
2. Surface type (e.g., asphalt, concrete): asphalt
3. Surface conditions (e.g., smooth, weathered): smooth
4. Vehicle types (e.g., cars, trucks): cars, trucks
5. Estimated daily vehicle traffic load (information available at local DOT): 15,100
   a. Measured or estimated?
6. Description of neighborhood (agricultural, residential, commercial, industrial: commercial
7. Are there construction sites within 0.5 miles, or unpaved road accesses other than residential driveways that would contribute to silt loading? If so, describe the severity of track-out and distance from sample location.
   No - past old construction site < 0.5 miles, not trackout
8. Describe surrounding soil type (e.g., loam, sand, clay...) clay
9. Weather Related Information:
   a. Has it rained in the past 48 hours? (Yes/No) Yes
   b. Has winter weather traction material been spread on the road in the past 30 days (Yes/No) No
   c. If so, what type of material (e.g., sand, salt, slag)
   d. How heavily was it spread? (lbs/mile/lane)
10. Weather conditions (over the past 24 hours)(e.d., sunny, windy): sunny

11. **Road Sample** surface dimensions for this sample

Sample Area		Length (ft)		Width (ft)		Area (m^2)
1		53.66		11.92		59.4213669
2		53.42		12.33		61.1903129
3		53.67		11.17		55.6929833
4		53.42		10.71		53.1507098

Note: The computer will calculate the area. Report 5'-6" as 5.5 ft.

Total Area 229.46 m^2

12. **Curb Sample:** Road edge description (e.g., curbed, ditch): curbed

a. Was a curb sample taken (Yes/No) Yes b. If so, **Sample Bag Identification Num.** BAG No. D-021

Surface dimensions for this sample. (Use a broom to collect any large debris and vacuum area from curb-side white line to curb. If no curb exists, collect the sample from the curb-side white line on hard paved shoulder surface to the beginning of grass or ditch.)

Sample Area		Length (ft)		Width (ft)		Area (m^2)
1		53.67		1.83		9.12427569
2		53.42		1.92		9.52841856
3						0
4						0

Note: The computer will calculate the area. Report 5'-6" as 5.5 ft.

Total Area 18.65 m^2

13. Sample Collection Team:

Sample Collection Team Members (Last names): Gatewood, Okabayashi

Organization Collecting Samples: PES

Organization Telephone Number: (919) 941-0333

Road Silt Analysis Data Sheet

Analysis Date: 8/6/97 **Bag ID No.:** D-020

Collection Location: Evans , St. Road 3048 Analyst:

Comments: Between Aviation Pkwy and Hwy 54

I. Moisture Analysis

Note: w.b. = wet basis, d.b. = dry basis

Balance properly zeroed and calibrated: 8/6/97 (Date)

Bag Contents		Filter Bag	
Pan & Sample Weight (w.b.), g	300.5	Bag & Pouch Tare Weight, g	70.4
Weighing Pan Tare Weight, g	211.3	Bag, Pouch & Sample Wt, (w.b.), g	165.7
Sample Weight (w.b.), g	89.2	Bag, Pouch & Silt Wt., brushed (w.b.), g	76.3
Pan & Sample Weight (d.b.), g	300.3	Silt Weight, (w.b.), g	5.9
Sample Weight (d.b.), g	89.0	Dried Bag, Pouch & Silt Wt. (d.b.), g	73.8
[redacted]	W_i	Silt Weight, (d.b.), g	3.4
[redacted]	W_f		

Percent Moisture Content, %M= 2.84%

$$\%M = \frac{W_i - W_f}{W_i} * 100$$

II. Particle Sizing Analysis and Silt Loading

Shaker Run Number	Elapsed Time (min)	Collection Pan & Silt Weight	Pan Tare Weight	Net	Change in Silt Weight, (%)
1 5	10	506.5	499.7	6.8	ZERO %
2 5	10	506.8	499.7	7.1	4.23%
3 5	10	506.9	499.7	7.2	1.39%
4			499.7	-500	101.44%

$$\Delta W = \frac{(W_{(i-1)} - W_{(i)})}{W_{(i-1)}} * 100$$

	No. 20 Sieve (g)	No. 200 Sieve (g)	Pan (g)
Final Weight, (g)	400.4	368.6	506.9
Tare Weight, (g)	382.5	304.7	499.7
Net Weight, (g)	17.9	63.9	7.2
Wt. Fraction, %	19.37%	69.16%	7.79%

Total Silt, (g) = Filter Silt + Pan Silt

Total Silt, (g) = 10.6

Area Swept, m^2 229.46

Silt Loading, g/m^2 4.62E-02

Silt Fraction, % 0.119101

SAMPLE MASS COMPARISION

Dry sample weight	92.4
Sized sample weight	92.4
Net Difference	0.0

Max allowable limit is 2% difference, or for this particular sample: 1.848 gms.

Curb Silt Analysis Data Sheet

Analysis Date: 8/6/97 | Bag ID No.: D-021

Collection Location: Evans, St. Road 3048 | Analyst: Frederici

Comments: Between Aviation Pkwy & Hwy 54

Note: Curb Sample Area

I. Moisture Analysis

Note: w.b. = wet basis, d.b. = dry basis

Balance properly zeroed and calibrated: 8/6/97 (Date)

Bag Contents		Filter Bag	
Combined Pan & Sample Weight (w.	301.9	Bag & Pouch Tare Weight, g	69.8
Weighing Pan Tare Weight, g	222.6	Bag, Pouch & Sample Wt, (w.b.), g	153.6
Sample Weight (w.b.), g	79.3	Bag, Pouch & Silt Wt., brushed (w.b.), g	73.9
Combined Pan & Sample Weight (d.	301.5	Silt Weight, (w.b.), g	4.1
Sample Weight (d.b.), g	78.9	Dried Bag, Pouch & Silt Wt. (d.b.), g	71.4
[illegible]	W_i	Silt Weight, (d.b.), g	1.6
[illegible]	W_f		

Percent Moisture Content % 3.48%

$$\%M = \frac{W_i - W_f}{W_i} * 100$$

II. Particle Sizing Analysis and Silt Loading

Shaker Run Number	Elapsed Time (min)	Collection Pan, Silt Weight, (%)	Pan Tare Weight	Pan Net	Change in Silt Weight, (%)
1 5	10	504.7	499.7	5	ZERO %
2 5	10	505	499.7	5.3	5.66%
3 5	10	505.1	499.7	5.4	1.85%
4			499.7	-499.7	101.08%

$$\Delta W = \frac{(W_{(i-1)} - W_{(i)})}{W_{(i-1)}} * 100$$

	No. 20 Sieve (g)	No. 200 Sieve (g)	Pan (g)
Final Weight, (g)	410.7	350.2	505.1
Tare Weight, (g)	382.1	304.9	499.7
Net Weight, (g)	28.6	45.3	5.4
Wt. Fraction, %	35.53%	56.27%	6.71%

Total Silt, (g) = Filter Silt + Pan Silt

Total Silt, (g) = 7

Area Swept, m^2 18.65

Silt Loading, g/m^2 3.75E-01

Silt Fraction, % 0.133843

SAMPLE MASS COMPARISION

Dry sample weight	80.5
Sized sample weight	80.9
Net Difference	-0.4

Max allowable limit is 2% difference, or for this particular sample: 1.61 gms.

SAMPLING DATA FROM PAVED ROADS

(Sample in accordance with AP-42, Appendix C.1.2)

Data Sample Collected 8/7/97 **Sample Bag Identification Number** D-040

Sampling Location
(e.g., Maple between 3rd and 4th Street) US1
Between Neuse River &
Burlington Mill Road

Road area zip code _____

Road description:

1. Number of lanes 4 Lane width _____ Posted traffic speed 55
2. Surface type (e.g., asphalt, concrete): asphalt
3. Surface conditions (e.g., smooth, weathered): smooth
4. Vehicle types (e.g., cars, trucks): all
5. Estimated daily vehicle traffic load (information available at local DOT): 36,300
   a. Measured or estimated? _____
6. Description of neighborhood (agricultural, residential, commercial, industrial: commercial
7. Are there construction sites within 0.5 miles, or unpaved road accesses other than residential driveways that would contribute to silt loading? If so, describe the severity of track-out and distance from sample location.
   No
8. Describe surrounding soil type (e.g., loam, sand, clay...) clay
9. Weather Related Information:
   a. Has it rained in the past 48 hours? (Yes/No) Yes
   b. Has winter weather traction material been spread on the road in the past 30 days (Yes/No) No
   c. If so, what type of material (e.g., sand, salt, slag) _____
   d. How heavily was it spread? (lbs/mile/lane) _____
10. Weather conditions (over the past 24 hours)(e.d., sunny, windy): sunny, cloudy, rainy

11. **Road Sample** *surface dimensions for this sample*

Sample Area		Length (ft)		Width (ft)		Area (m^2)
1		52.83		11.83		58.0605398
2		52.17		11.85		57.4321271
3		52.17		11		53.312523
4		51.83		11.42		54.9873799

Note: The computer will calculate the area. Report 5'-6" as 5.5 ft.

Total Area 223.79 m^2

12. **Curb Sample:** Road edge description (e.g., curbed, ditch): shoulder (r,l), ditch (l)

a. Was a curb sample taken (Yes/No) Yes b. If so, **Sample Bag Identification Num.**
BAG No. **D-041**

Surface dimensions for this sample. (Use a broom to collect any large debris and vacuum area from curb-side white line to curb. *If no curb exists, collect the sample from* the curb-side white line on hard paved shoulder surface to the beginning of grass or ditch.)

Sample Area		Length (ft)		Width (ft)		Area (m^2)
1		52.83		9.67		47.4594607
2		52.17		9.83		47.6420092
3		52.17		3.83		18.5624512
4		51.83		3.83		18.4414768

Note: The computer will calculate the area. Report 5'-6" as 5.5 ft.

Total Area 132.11 m^2

13. Sample Collection Team:

Sample Collection Team Members (Last names): Gatewood, Mullen, Okabayashi

Organization Collecting Samples: PES

Organization Telephone Number: (919) 941-0333

Road Silt Analysis Data Sheet

Analysis Date: 8/12/97 | Bag ID No.: D-040

Collection Location: US 1 | Analyst: Frederici

Comments: Between Neuse River & Burlington Mill Road

I. Moisture Analysis

Note: w.b. = wet basis, d.b. = dry basis

Balance properly zeroed and calibrated: 8/12/97 (Date)

Bag Contents		Filter Bag	
Pan & Sample Weight (w.b.), g	326.6	Bag & Pouch Tare Weight, g	92.8
Weighing Pan Tare Weight, g	218.7	Bag, Pouch & Sample Wt, (w.b.), g	211
Sample Weight (w.b.), g	107.9	Bag, Pouch & Silt Wt., brushed (w.b.), g	102.5
Pan & Sample Weight (d.b.), g	326.2	Silt Weight, (w.b.), g	9.7
Sample Weight (d.b.), g	107.5	Dried Bag, Pouch & Silt Wt. (d.b.), g	100.9
[redacted]	W_i	Silt Weight, (d.b.), g	8.1
[redacted]	W_f		

Percent Moisture Content, %M= 1.70%

$$\%M = \frac{W_i - W_f}{W_i} * 100$$

II. Particle Sizing Analysis and Silt Loading

Shaker Run Number	Elapsed Time (min)	Collection Pan & Silt Weight	Pan Tare Weight	Pan Net	Change in Silt Weight, (%)
1 5	10	510	499.6	10.4	ZERO %
2 5	10	510.7	499.6	11.1	6.31%
3 5	10	510.8	499.6	11.2	0.89%
4			499.6	-500	102.24%

$$\Delta W = \frac{(W_{(i-1)} - W_{(i)})}{W_{(i-1)}} * 100$$

	No. 20 Sieve (g)	No. 200 Sieve (g)	Pan (g)
Final Weight, (g)	396.8	386.7	510.8
Tare Weight, (g)	382.4	304.6	499.6
Net Weight, (g)	14.4	82.1	11.2
Wt. Fraction, %	12.46%	71.02%	9.69%

Total Silt, (g) = Filter Silt + Pan Silt

Total Silt, (g) = 19.3

Area Swept, m^2 223.79

Silt Loading, g/m^2 8.62E-02

Silt Fraction, % 0.179201

SAMPLE MASS COMPARISION

Dry sample weight	115.6
Sized sample weight	115.8
Net Difference	-0.2

Max allowable limit is 2% difference, or for this particular sample: 2.312 gms.

Curb Silt Analysis Data Sheet

Analysis Date: 8/12/97 | Bag ID No.: D-041

Collection Location: US 1 | Analyst: Frederici

Comments: Betweeen Neuse River & Burlington Mill Road

Note: shoulder - right lane/ Ditch- left lane

I. Moisture Analysis

Note: w.b. = wet basis, d.b. = dry basis

Balance properly zeroed and calibrated: 8/12/97 (Date)

Bag Contents		Filter Bag	
Combined Pan & Sample Weight (w.	672.5	Bag & Pouch Tare Weight, g	91.1
Weighing Pan Tare Weight, g	211.2	Bag, Pouch & Sample Wt, (w.b.), g	574.6
Sample Weight (w.b.), g	461.3	Bag, Pouch & Silt Wt., brushed (w.b.), g	112.2
Combined Pan & Sample Weight (d.	670.6	Silt Weight, (w.b.), g	21.1
Sample Weight (d.b.), g	459.4	Dried Bag, Pouch & Silt Wt. (d.b.), g	110.4
[illegible]	W_i	Silt Weight, (d.b.), g	19.3
[illegible]	W_f		

Percent Moisture Content % 0.77%

$$\%M = \frac{W_i - W_f}{W_i} * 100$$

II. Particle Sizing Analysis and Silt Loading

Shaker Run Number	Elapsed Time (min)	Collection Pan, Silt Weight, (%)	Pan Tare Weight	Pan Net	Change in Silt Weight, (%)
1 5	10	562.4	499.6	62.8	ZERO %
2 5	10	566	499.6	66.4	5.42%
3 5	10	568.1	499.6	68.5	3.07%
4 5	10	568.3	499.6	68.7	0.29%

$$\Delta W = \frac{(W_{(i-1)} - W_{(i)})}{W_{(i-1)}} * 100$$

Total Silt, (g) = Filter Silt + Pan Silt

Total Silt, (g) = 88

	No. 20 Sieve (g)	No. 200 Sieve (g)	Pan (g)
Final Weight, (g)	473.3	605.6	568.3
Tare Weight, (g)	382.3	304.7	499.6
Net Weight, (g)	91	300.9	68.7
Wt. Fraction, %	19.01%	62.86%	14.35%

Area Swept, m^2 132.11

Silt Loading, g/m^2 6.66E-01

Silt Fraction, % 0.226279

SAMPLE MASS COMPARISION

Dry sample weight	478.7
Sized sample weight	479.9
Net Difference	-1.2

Max allowable limit is 2% difference, or for this particular sample: 9.574 gms.

SAMPLING DATA FROM PAVED ROADS

(Sample in accordance with AP-42, Appendix C.1.2)

Data Sample Collected 7/30/97 **Sample Bag Identification Number** D-027

Sampling Location
(e.g., Maple between 3rd and 4th Street) Wade Avenue
Between Dogwood & Dixie Trail

Road area zip code _____

Road description:

1. Number of lanes 4 Lane width _____ Posted traffic speed 45
2. Surface type (e.g., asphalt, concrete): asphalt
3. Surface conditions (e.g., smooth, weathered): smooth
4. Vehicle types (e.g., cars, trucks): both
5. Estimated daily vehicle traffic load (information available at local DOT): 22,000
   a. Measured or estimated? _____
6. Description of neighborhood (agricultural, residential, commercial, industrial: residential
7. Are there construction sites within 0.5 miles, or unpaved road accesses other than residential driveways that would contribute to silt loading? If so, describe the severity of track-out and distance from sample location.

8. Describe surrounding soil type (e.g., loam, sand, clay...) clay
9. Weather Related Information:
   a. Has it rained in the past 48 hours? (Yes/No) Yes
   b. Has winter weather traction material been spread on the road in the past 30 days (Yes/No) No
   c. If so, what type of material (e.g., sand, salt, slag) _____
   d. How heavily was it spread? (lbs/mile/lane) _____
10. Weather conditions (over the past 24 hours)(e.d., sunny, windy): partly cloudy

11. **Road Sample** surface dimensions for this sample

Sample Area		Length (ft)		Width (ft)		Area (m^2)
1		50.25		10.5		49.0163625
2		50.25		10.5		49.0163625
3		50		9.67		44.91715
4		50		10.1		46.9145

Note: The computer will calculate the area. Report 5'-6" as 5.5 ft.

Total Area 189.86 m^2

12. **Curb Sample:** Road edge description (e.g., curbed, ditch): curbed

a. Was a curb sample taken (Yes/No) Yes b. If so, **Sample Bag Identification Num.** BAG No. D-028

Surface dimensions for this sample. (Use a broom to collect any large debris and vacuum area from curb-side white line to curb. If no curb exists, collect the sample from the curb-side white line on hard paved shoulder surface to the beginning of grass or ditch.)

Sample Area		Length (ft)		Width (ft)		Area (m^2)
1		50.25		1.75		8.16939375
2						0
3						0
4						0

Note: The computer will calculate the area. Report 5'-6" as 5.5 ft.

Total Area 8.17 m^2

13. Sample Collection Team:

Sample Collection Team Members (Last names): Gatewood, White

Organization Collecting Samples: PES

Organization Telephone Number: (919) 941-0333

Road Silt Analysis Data Sheet

Analysis Date: 8/7/97 | Bag ID No.: D-027

Collection Location: Wade Avenue | Analyst: Frederici

Comments: Between Dogwood & Dixie Trail

I. Moisture Analysis

Note: w.b. = wet basis, d.b. = dry basis

Balance properly zeroed and calibrated: 8/7/97 (Date)

Bag Contents		Filter Bag	
Pan & Sample Weight (w.b.), g	268.4	Bag & Pouch Tare Weight, g	70
Weighing Pan Tare Weight, g	222.6	Bag, Pouch & Sample Wt, (w.b.), g	120.1
Sample Weight (w.b.), g	45.8	Bag, Pouch & Silt Wt., brushed (w.b.), g	74.2
Pan & Sample Weight (d.b.), g	268.2	Silt Weight, (w.b.), g	4.2
Sample Weight (d.b.), g	45.6	Dried Bag, Pouch & Silt Wt. (d.b.), g	71.1
[illegible]	W_i	Silt Weight, (d.b.), g	1.1
[illegible]	W_f		

Percent Moisture Content, %M= 6.60%

$$\%M = \frac{W_i - W_f}{W_i} * 100$$

II. Particle Sizing Analysis and Silt Loading

Shaker Run Number	Elapsed Time (min)	Collection Pan & Silt Weight	Pan Tare Weight	Net	Change in Silt Weight, (%)
1 5	10	503.3	499.6	3.7	ZERO %
2 5	10	503.6	499.6	4	7.50%
3 5	10	503.7	499.6	4.1	2.44%
4			499.6	-500	100.82%

$$\Delta W = \frac{(W_{(i-1)} - W_{(i)})}{W_{(i-1)}} * 100$$

	No. 20 Sieve (g)	No. 200 Sieve (g)	Pan (g)
Final Weight, (g)	386.1	342.2	503.7
Tare Weight, (g)	382	304.7	499.6
Net Weight, (g)	4.1	37.5	4.1
Wt. Fraction, %	8.78%	80.30%	8.78%

Total Silt, (g) = Filter Silt + Pan Silt

Total Silt, (g) = 5.2

Area Swept, m^2 189.86

Silt Loading, g/m^2 2.74E-02

Silt Fraction, % 0.113786

SAMPLE MASS COMPARISION

Dry sample weight	46.7
Sized sample weight	46.8
Net Difference	-0.1

Max allowable limit is 2% difference, or for this particular sample: 0.934 gms.

Curb Silt Analysis Data Sheet

Analysis Date: 8/7/97 | Bag ID No.: D-028

Collection Location: Wade Avenue | Analyst: Frederici

Comments: Between Dogwood & Dixie Trail

Note: Curb Sample Area

I. Moisture Analysis

Note: w.b. = wet basis, d.b. = dry basis

Balance properly zeroed and calibrated: 8/7/97 (Date)

Bag Contents		Filter Bag	
Combined Pan & Sample Weight (w.	395.8	Bag & Pouch Tare Weight, g	76.3
Weighing Pan Tare Weight, g	222.4	Bag, Pouch & Sample Wt, (w.b.), g	254.3
Sample Weight (w.b.), g	173.4	Bag, Pouch & Silt Wt., brushed (w.b.), g	80.8
Combined Pan & Sample Weight (d.	394.7	Silt Weight, (w.b.), g	4.5
Sample Weight (d.b.), g	172.3	Dried Bag, Pouch & Silt Wt. (d.b.), g	78.1
[illegible]	W_i	Silt Weight, (d.b.), g	1.8
[illegible]	W_f		

Percent Moisture Content % 2.14%

$$\%M = \frac{W_i - W_f}{W_i} * 100$$

II. Particle Sizing Analysis and Silt Loading

Shaker Run Number		Elapsed Time (min)	Collection Pan, Silt Weight, (%)	Pan Tare Weight	Net	Change in Silt Weight, (%)
1	5	10	506.7	499.6	7.1	ZERO %
2	5	10	507.2	499.6	7.6	6.58%
3	5	10	507.5	499.6	7.9	3.80%
4	5	10	507.5	499.6	7.9	0.00%

$$\Delta W = \frac{(W_{(i-1)} - W_{(i)})}{W_{(i-1)}} * 100$$

Total Silt, (g) = Filter Silt + Pan Silt

Total Silt, (g) = 9.7

	No. 20 Sieve (g)	No. 200 Sieve (g)	Pan (g)
Final Weight, (g)	429.8	421.2	507.5
Tare Weight, (g)	382	304.6	499.6
Net Weight, (g)	47.8	116.6	7.9
Wt. Fraction, %	27.46%	66.97%	4.54%

Area Swept, m^2 8.17

Silt Loading, g/m^2 1.19E+00

Silt Fraction, % 0.076801

SAMPLE MASS COMPARISION

Dry sample weight	174.1
Sized sample weight	174.1
Net Difference	0.0

Max allowable limit is 2% difference, or for this particular sample: 3.482 gms.

SAMPLING DATA FROM PAVED ROADS

(Sample in accordance with AP-42, Appendix C.1.2)

Data Sample Collected 07/37/97 **Sample Bag Identification Number** D-029

Sampling Location
(e.g., Maple between 3rd and 4th Street) Hwy 70
Between Angier & Miami

Road area zip code _____

Road description:

1. Number of lanes 4 Lane width _____ Posted traffic speed 55
2. Surface type (e.g., asphalt, concrete): asphalt
3. Surface conditions (e.g., smooth, weathered): smooth
4. Vehicle types (e.g., cars, trucks): all
5. Estimated daily vehicle traffic load (information available at local DOT): 16,100
   a. Measured or estimated? _____
6. Description of neighborhood (agricultural, residential, commercial, industrial: commercial, residential
7. Are there construction sites within 0.5 miles, or unpaved road accesses other than residential driveways that would contribute to silt loading? If so, describe the severity of track-out and distance from sample location.
   No
8. Describe surrounding soil type (e.g., loam, sand, clay...) loam
9. Weather Related Information:
   a. Has it rained in the past 48 hours? (Yes/No) Yes
   b. Has winter weather traction material been spread on the road in the past 30 days (Yes/No) No
   c. If so, what type of material (e.g., sand, salt, slag) _____
   d. How heavily was it spread? (lbs/mile/lane) _____
10. Weather conditions (over the past 24 hours)(e.d., sunny, windy): windy, sunny, rainy, cloudy

11. **Road Sample** surface dimensions for this sample

Sample Area		Length (ft)		Width (ft)		Area (m^2)
1		50		11.33		52.62785
2		50		11.33		52.62785
3		50		10.33		47.98285
4		50		10.58		49.1441

Note: The computer will calculate the area. Report 5'-6" as 5.5 ft.

Total Area 202.38 m^2

12. **Curb Sample:** Road edge description (e.g., curbed, ditch): shoulder on right and left; ditch on right

a. Was a curb sample taken (Yes/No) Yes b. If so, **Sample Bag Identification Num.** BAG No. D-030

Surface dimensions for this sample. (Use a broom to collect any large debris and vacuum area from curb-side white line to curb. If no curb exists, collect the sample from the curb-side white line on hard paved shoulder surface to the beginning of grass or ditch.)

Sample Area		Length (ft)		Width (ft)		Area (m^2)
1		50		1.83		8.50035
2		50		1.75		8.12875
3		50		2.1		9.7545
4		50		1.67		7.75715

Note: The computer will calculate the area. Report 5'-6" as 5.5 ft.

Total Area 34.14 m^2

13. Sample Collection Team:

Sample Collection Team Members (Last names): Gatewood, White, Okabayashi

Organization Collecting Samples: PES

Organization Telephone Number: (919) 941-0333

Road Silt Analysis Data Sheet

Analysis Date: 8/7/97 | Bag ID No.: D-029

Collection Location: Hwy 70 | Analyst: Frederici

Comments: Between Angier & Miami Blvd

I. Moisture Analysis

Note: w.b. = wet basis, d.b. = dry basis

Balance properly zeroed and calibrated: 8/7/97 (Date)

Bag Contents		Filter Bag	
Pan & Sample Weight (w.b.), g	227.9	Bag & Pouch Tare Weight, g	75.3
Weighing Pan Tare Weight, g	217.9	Bag, Pouch & Sample Wt, (w.b.), g	88.7
Sample Weight (w.b.), g	10.0	Bag, Pouch & Silt Wt., brushed (w.b.), g	78.6
Pan & Sample Weight (d.b.), g	228.0	Silt Weight, (w.b.), g	3.3
Sample Weight (d.b.), g	10.1	Dried Bag, Pouch & Silt Wt. (d.b.), g	76.1
[redacted]	W_i	Silt Weight, (d.b.), g	0.8
	W_f		

Percent Moisture Content, %M= 18.05%

$$\%M = \frac{W_i - W_f}{W_i} * 100$$

II. Particle Sizing Analysis and Silt Loading

Shaker Run Number	Elapsed Time (min)	Collection Pan & Silt Weight	Pan Tare Weight	Net	Change in Silt Weight, (%)
1 5	10	501	499.6	1.4	ZERO %
2 5	10	501.2	499.6	1.6	12.50%
3 5	10	501.2	499.6	1.6	0.00%
4 5	10	501.3	499.6	1.7	5.88%

$$\Delta W = \frac{(W_{(i-1)} - W_{(i)})}{W_{(i-1)}} * 100$$

Total Silt, (g) = Filter Silt + Pan Silt

Total Silt, (g) = 2.5

	No. 20 Sieve (g)	No. 200 Sieve (g)	Pan (g)
Final Weight, (g)	384	311.4	501.3
Tare Weight, (g)	382.1	304.6	499.6
Net Weight, (g)	1.9	6.8	1.7
Wt. Fraction, %	17.43%	62.39%	15.60%

Area Swept, m^2 202.38

Silt Loading, g/m^2 1.24E-02

Silt Fraction, % 0.240385

SAMPLE MASS COMPARISION

Dry sample weight	10.9
Sized sample weight	11.2
Net Difference	-0.3

Max allowable limit is 2% difference, or for this particular sample: 0.218 gms.

Curb Silt Analysis Data Sheet

Analysis Date: 08/0797 | Bag ID No.: D-030

Collection Location: Hwy 70 | Analyst:

Comments: Between Angier & Miami Blvd.

Note: Curb Sample Area

I. Moisture Analysis

Note: w.b. = wet basis, d.b. = dry basis

Balance properly zeroed and calibrated: 8/7/97 (Date)

Bag Contents		Filter Bag	
Combined Pan & Sample Weight (w.	302.0	Bag & Pouch Tare Weight, g	76
Weighing Pan Tare Weight, g	226.5	Bag, Pouch & Sample Wt, (w.b.), g	159.7
Sample Weight (w.b.), g	75.5	Bag, Pouch & Silt Wt., brushed (w.b.), g	80.8
Combined Pan & Sample Weight (d.	300.9	Silt Weight, (w.b.), g	4.8
Sample Weight (d.b.), g	74.4	Dried Bag, Pouch & Silt Wt. (d.b.), g	78.9
[redacted]	W_i	Silt Weight, (d.b.), g	2.9
	W_f		

Percent Moisture Content % 3.74%

$$\%M = \frac{W_i - W_f}{W_i} * 100$$

II. Particle Sizing Analysis and Silt Loading

Shaker Run Number	Elapsed Time (min)	Collection Pan, Silt Weight, (%)	Pan Tare Weight	Pan Net	Change in Silt Weight, (%)
1	5	10	504	499.6	4.4	ZERO %
2	5	10	504.2	499.6	4.6	4.35%
3	5	10	504.4	499.6	4.8	4.17%
4	5	10	504.6	499.6	5	4.00%

$$\Delta W = \frac{(W_{(i-1)} - W_{(i)})}{W_{(i-1)}} * 100$$

	No. 20 Sieve (g)	No. 200 Sieve (g)	Pan (g)
Final Weight, (g)	422.7	338.3	504.6
Tare Weight, (g)	382.1	304.7	499.6
Net Weight, (g)	40.6	33.6	5
Wt. Fraction, %	52.52%	43.47%	6.47%

Total Silt, (g) = Filter Silt + Pan Silt

Total Silt, (g) = 7.9

Area Swept, m^2 34.14

Silt Loading, g/m^2 2.31E-01

Silt Fraction, % 0.190361

SAMPLE MASS COMPARISION

Dry sample weight	77.3
Sized sample weight	82.1
Net Difference	-4.8

Max allowable limit is 2% difference, or for this particular sample: 1.546 gms.

SAMPLING DATA FROM PAVED ROADS

(Sample in accordance with AP-42, Appendix C.1.2)

Data Sample Collected 7/25/97 **Sample Bag Identification Number** D-018

Sampling Location
(e.g., Maple between 3rd and 4th Street) Morrisville Parkway between St. Road 1613 and Hwy 54

Road area zip code _____

Road description:

1. Number of lanes 4 Lane width _____ Posted traffic speed 45
2. Surface type (e.g., asphalt, concrete): asphalt
3. Surface conditions (e.g., smooth, weathered): smooth from weathering, loose asphalt
4. Vehicle types (e.g., cars, trucks): cars
5. Estimated daily vehicle traffic load (information available at local DOT): 5,500
   a. Measured or estimated? _____
6. Description of neighborhood (agricultural, residential, commercial, industrial: residential
7. Are there construction sites within 0.5 miles, or unpaved road accesses other than residential driveways that would contribute to silt loading? If so, describe the severity of track-out and distance from sample location.
   No
8. Describe surrounding soil type (e.g., loam, sand, clay...) Loam w/ St. Augustine grass
9. Weather Related Information:
   a. Has it rained in the past 48 hours? (Yes/No) Yes
   b. Has winter weather traction material been spread on the road in the past 30 days (Yes/No) No
   c. If so, what type of material (e.g., sand, salt, slag) _____
   d. How heavily was it spread? (lbs/mile/lane) _____
10. Weather conditions (over the past 24 hours)(e.d., sunny, windy): sunny, hot

11. **Road Sample** *surface dimensions for this sample*

Sample Area		Length (ft)		Width (ft)		Area (m^2)
1		53		10.33		50.861821
2		53		10.58		52.092746
3		53.25		11.1		54.9108675
4		53.33		11.1		54.9933627

Note: The computer will calculate the area. Report 5'-6" as 5.5 ft.

Total Area 212.86 m^2

12. **Curb Sample:** Road edge description (e.g., curbed, ditch): curbed

a. Was a curb sample taken (Yes/No) _____ b. If so, **Sample Bag Identification Num.**

BAG No. D-019

Surface dimensions for this sample. (Use a broom to collect any large debris and vacuum area from curb-side white line to curb. *If no curb exists, collect the sample from* the curb-side white line on hard paved shoulder surface to the beginning of grass or ditch.)

Sample Area		Length (ft)		Width (ft)		Area (m^2)
1		53		1.33		6.548521
2		53		1.83		9.010371
3		53.25		1.75		8.65711875
4		23.33		1.79		3.87956903

Note: The computer will calculate the area. Report 5'-6" as 5.5 ft.

Total Area 28.10 m^2

13. Sample Collection Team:

Sample Collection Team Members (Last names)	Okabayashi	Gatewood
	Grable	
Organization Collecting Samples	PES	
Organization Telephone Number	(919) 941-0333	

Road Silt Analysis Data Sheet

Analysis Date: 8/6/97 | Bag ID No.: D-018

Collection Location: Morrisville Pkwy | Analyst: Frederici

Comments: between St. Road 1663 & Hwy 54

I. Moisture Analysis

Note: w.b. = wet basis, d.b. = dry basis

Balance properly zeroed and calibrated: 8/6/97 (Date)

Bag Contents		Filter Bag	
Pan & Sample Weight (w.b.), g	444.9	Bag & Pouch Tare Weight, g	70.5
Weighing Pan Tare Weight, g	222.6	Bag, Pouch & Sample Wt, (w.b.), g	299.7
Sample Weight (w.b.), g	222.3	Bag, Pouch & Silt Wt., brushed (w.b.), g	77.1
Pan & Sample Weight (d.b.), g	444.5	Silt Weight, (w.b.), g	6.6
Sample Weight (d.b.), g	221.9	Dried Bag, Pouch & Silt Wt. (d.b.), g	74.4
[redacted]	W_i	Silt Weight, (d.b.), g	3.9
	W_f		

Percent Moisture Content, %M= 1.35%

$$\%M = \frac{W_i - W_f}{W_i} * 100$$

II. Particle Sizing Analysis and Silt Loading

Shaker Run Number	Elapsed Time (min)	Collection Pan & Silt Weight	Pan Tare Weight	Net	Change in Silt Weight, (%)
1 5	10	511.2	499.7	11.5	ZERO %
2 5	10	511.9	499.7	12.2	5.74%
3 5	10	512.3	499.7	12.6	3.17%
4 5	10	512.4	499.7	12.7	0.79%

$$\Delta W = \frac{(W_{(i-1)} - W_{(i)})}{W_{(i-1)}} * 100$$

	No. 20 Sieve (g)	No. 200 Sieve (g)	Pan (g)
Final Weight, (g)	448.3	447.5	512.4
Tare Weight, (g)	381.7	304.7	499.7
Net Weight, (g)	66.6	142.8	12.7
Wt. Fraction, %	29.50%	63.24%	5.62%

Total Silt, (g) = Filter Silt + Pan Silt

Total Silt, (g) = 16.6

Area Swept, m^2 212.86

Silt Loading, g/m^2 7.80E-02

Silt Fraction, % 0.074741

SAMPLE MASS COMPARISION

Dry sample weight	225.8
Sized sample weight	226.0
Net Difference	-0.2

Max allowable limit is 2% difference, or for this particular sample: 4.516 gms.

Curb Silt Analysis Data Sheet

Analysis Date: 8/6/97 | Bag ID No.: D-019

Collection Location: Morrisville Pkwy | Analyst:

Comments: between St. Road 1613 & Hwy 54

Note: Curb sample area

I. Moisture Analysis

Note: w.b. = wet basis, d.b. = dry basis

Balance properly zeroed and calibrated: 8/6/97 (Date)

Bag Contents		Filter Bag	
Combined Pan & Sample Weight (w.	806.9	Bag & Pouch Tare Weight, g	70.8
Weighing Pan Tare Weight, g	222.4	Bag, Pouch & Sample Wt, (w.b.), g	664
Sample Weight (w.b.), g	584.5	Bag, Pouch & Silt Wt., brushed (w.b.), g	79.2
Combined Pan & Sample Weight (d.	804.3	Silt Weight, (w.b.), g	8.4
Sample Weight (d.b.), g	581.9	Dried Bag, Pouch & Silt Wt. (d.b.), g	76.6
[redacted]	W_i	Silt Weight, (d.b.), g	5.8
	W_f		

Percent Moisture Content % 0.88%

$$\%M = \frac{W_i - W_f}{W_i} * 100$$

II. Particle Sizing Analysis and Silt Loading

Shaker Run Number	Elapsed Time (min)	Collection Pan, Silt Weight, (%)	Pan Tare Weight	Pan Net	Change in Silt Weight, (%)
1 5	10	527.3	499.7	27.6	ZERO %
2 5	10	529.2	499.7	29.5	6.44%
3 5	10	530.8	499.7	31.1	5.14%
4 5	10	532.2	499.7	32.5	4.31%

$$\Delta W = \frac{(W_{(i-1)} - W_{(i)})}{W_{(i-1)}} * 100$$

	No. 20 Sieve (g)	No. 200 Sieve (g)	Pan (g)
Final Weight, (g)	605.8	630.8	532.2
Tare Weight, (g)	381.8	304.7	499.7
Net Weight, (g)	224	326.1	32.5
Wt. Fraction, %	38.11%	55.49%	5.53%

Total Silt, (g) = Filter Silt + Pan Silt

Total Silt, (g) = 38.3

Area Swept, m^2 28.10

Silt Loading, g/m^2 1.36E+00

Silt Fraction, % 0.105104

SAMPLE MASS COMPARISION

Dry sample weight	587.7
Sized sample weight	588.4
Net Difference	-0.7

Max allowable limit is 2% difference, or for this particular sample: 11.754 gms.

SAMPLING DATA FROM PAVED ROADS

(Sample in accordance with AP-42, Appendix C.1.2)

Data Sample Collected 7/21/97 **Sample Bag Identification Number** D-014

Sampling Location
(e.g., Maple between 3rd and 4th Street) S. Miami Blvd between Alexander and Cornwallis

Road area zip code _____

Road description:

1. Number of lanes 4 Lane width 11' + 9" Posted traffic speed 45 mph
2. Surface type (e.g., asphalt, concrete): asphalt
3. Surface conditions (e.g., smooth, weathered): smooth
4. Vehicle types (e.g., cars, trucks): all
5. Estimated daily vehicle traffic load (information available at local DOT): 15,600
   a. Measured or estimated? _____
6. Description of neighborhood (agricultural, residential, commercial, industrial: heterogeneous
7. Are there construction sites within 0.5 miles, or unpaved road accesses other than residential driveways that would contribute to silt loading? If so, describe the severity of track-out and distance from sample location.
   No
8. Describe surrounding soil type (e.g., loam, sand, clay...) loam
9. Weather Related Information:
   a. Has it rained in the past 48 hours? (Yes/No) No
   b. Has winter weather traction material been spread on the road in the past 30 days (Yes/No) _____
   c. If so, what type of material (e.g., sand, salt, slag) _____
   d. How heavily was it spread? (lbs/mile/lane) _____
10. Weather conditions (over the past 24 hours)(e.d., sunny, windy): sunny, hot

11. **Road Sample** *surface dimensions for this sample*

Sample Area		Length (ft)		Width (ft)		Area (m^2)
1		50		11.75		54.57875
2		50		11.92		55.3684
3		50		11.25		52.25625
4		50		11.41		52.99945

Note: The computer will calculate the area. Report 5'-6" as 5.5 ft.

Total Area 215.20 m^2

12. **Curb Sample:** Road edge description (e.g., curbed, ditch): curbed (r), turning lane (l)

a. Was a curb sample taken (Yes/No) _____ b. If so, **Sample Bag Identification Num.**
BAG No. D-013

Surface dimensions for this sample. (Use a broom to collect any large debris and vacuum area from curb-side white line to curb. If no curb exists, collect the sample from the curb-side white line on hard paved shoulder surface to the beginning of grass or ditch.)

Sample Area		Length (ft)		Width (ft)		Area (m^2)
1		50		1.83		8.50035
2		50		1.5		6.9675
3						0
4						0

Note: The computer will calculate the area. Report 5'-6" as 5.5 ft.

Total Area 15.47 m^2

13. Sample Collection Team:

Sample Collection Team Members (Last names): Mullen, Okabayashi

Organization Collecting Samples: PES

Organization Telephone Number: (919) 941-0333

Road Silt Analysis Data Sheet

Analysis Date: 8/11/97 | Bag ID No.: D-014

Collection Location: South Miami Blvd | Analyst: Frederici

Comments: between Cornwallis & Alexander

I. Moisture Analysis

Note: w.b. = wet basis, d.b. = dry basis

Balance properly zeroed and calibrated: 8/11/97 (Date)

Bag Contents		Filter Bag	
Pan & Sample Weight (w.b.), g	460.8	Bag & Pouch Tare Weight, g	70.8
Weighing Pan Tare Weight, g	293.4	Bag, Pouch & Sample Wt, (w.b.), g	247.7
Sample Weight (w.b.), g	167.4	Bag, Pouch & Silt Wt., brushed (w.b.), g	80.1
Pan & Sample Weight (d.b.), g	459.7	Silt Weight, (w.b.), g	9.3
Sample Weight (d.b.), g	166.3	Dried Bag, Pouch & Silt Wt. (d.b.), g	76.9
[redacted]	W_i	Silt Weight, (d.b.), g	6.1
	W_f		

Percent Moisture Content, %M= 2.43%

$$\%M = \frac{W_i - W_f}{W_i} * 100$$

II. Particle Sizing Analysis and Silt Loading

Shaker Run Number	Elapsed Time (min)	Collection Pan & Silt Weight	Pan Tare Weight	Pan Net	Change in Silt Weight, (%)
1 5	10	514.3	499.6	14.7	ZERO %
2 5	10	516.7	499.6	17.1	14.04%
3 5	10	514.6	499.6	15	-14.00%
4 5	10	515.3	499.6	15.7	4.46%

$$\Delta W = \frac{(W_{(i-1)} - W_{(i)})}{W_{(i-1)}} * 100$$

	No. 20 Sieve (g)	No. 200 Sieve (g)	Pan (g)
Final Weight, (g)	442.5	394.2	515.3
Tare Weight, (g)	381.8	304.8	499.6
Net Weight, (g)	60.7	89.4	15.7
Wt. Fraction, %	35.21%	51.86%	9.11%

Total Silt, (g) = Filter Silt + Pan Silt

Total Silt, (g) = 21.8

Area Swept, m^2 215.20

Silt Loading, g/m^2 1.01E-01

Silt Fraction, % 0.131484

SAMPLE MASS COMPARISION

Dry sample weight	172.4
Sized sample weight	171.9
Net Difference	0.5

Max allowable limit is 2% difference, or for this particular sample: 3.448 gms.

Curb Silt Analysis Data Sheet

Analysis Date: 8/11/97 **Bag ID No.:** D-015

Collection Locatio S. Miami Blvd Analyst: Frederici

Comments: Left side curb area unsafe. Sample not recovered for that side of the road.

I. Moisture Analysis

Note: w.b. = wet basis, d.b. = dry basis

Balance properly zeroed and calibrated: _____ Date

Bag Contents		Filter Bag	
Combined Pan & Sample Weight (w.	1141.2	Bag & Pouch Tare Weight, g	71.4
Weighing Pan Tare Weight, g	295.5	Bag, Pouch & Sample Wt, (w.b.), g	925.4
Sample Weight (w.b.), g	845.7	Bag, Pouch & Silt Wt., brushed (w.b.), g	78.2
Combined Pan & Sample Weight (d.	1140.1	Silt Weight, (w.b.), g	6.8
Sample Weight (d.b.), g	844.6	Dried Bag, Pouch & Silt Wt. (d.b.), g	77.4
[illegible]	852.5 W_i	Silt Weight, (d.b.), g	6
[illegible]	8501.6 W_f		

Percent Moisture Content % 0.22%

$$\%M = \frac{W_i - W_f}{W_i} * 100$$

II. Particle Sizing Analysis and Silt Loading

Shaker Run Number	Elapsed Time (min)	Collection Pan, Silt Weight, (%)	Pan Tare Weight	Pan Net	Change in Silt Weight, (%)
1		585.9	499.6	86.3	ZERO %
2		591.8	499.6	92.2	6.40%
3			499.6	-499.6	118.45%
4			499.6	-499.6	0.00%

$$\Delta W = \frac{(W_{(i-1)} - W_{(i)})}{W_{(i-1)}} * 100$$

Total Silt, (g) = Filter Silt + Pan Silt

Total Silt, (g) = 62

	No. 20 Sieve (g)	No. 200 Sieve (g)	Pan (g)
Final Weight, (g)	673.6	796.9	555.6
Tare Weight, (g)	382.8	304.7	499.6
Net Weight, (g)	290.8	492.2	56
Wt. Fraction, %	34.19%	57.87%	6.58%

Area Swept, m^2 15.47

Silt Loading, g/m^2 4.01E+00

Silt Fraction, % 0.111873

SAMPLE MASS COMPARISION

Dry sample weight	850.6
Sized sample weight	845.0
Net Difference	5.6

Max allowable limit is 2% difference, or for this particular sample: 17.012 gms.

Road Silt Analysis Data Sheet

Analysis Date: 8/7/97 | **Bag ID No.:** D-031

Collection Location: Creedmore | Analyst: Frederici

Comments: Between Hwy 70 & Millwood

I. Moisture Analysis

Note: w.b. = wet basis, d.b. = dry basis

Balance properly zeroed and calibrated: 8/7/97 (Date)

Bag Contents		Filter Bag	
Pan & Sample Weight (w.b.), g	260.9	Bag & Pouch Tare Weight, g	92.1
Weighing Pan Tare Weight, g	218.6	Bag, Pouch & Sample Wt, (w.b.), g	136
Sample Weight (w.b.), g	42.3	Bag, Pouch & Silt Wt., brushed (w.b.), g	84.3
Pan & Sample Weight (d.b.), g	260.8	Silt Weight, (w.b.), g	-7.8
Sample Weight (d.b.), g	42.2	Dried Bag, Pouch & Silt Wt. (d.b.), g	98.1
[redacted]	W_i	Silt Weight, (d.b.), g	4
[redacted]	W_f		

94.3

Percent Moisture Content, %M= -33.91%

$$\%M = \frac{W_i - W_f}{W_i} * 100$$

II. Particle Sizing Analysis and Silt Loading

Shaker Run Number		Elapsed Time (min)	Collection Pan & Silt Weight	Pan Tare Weight	Pan Net	Change in Silt Weight, (%)
1	5	10	503.2	499.8	3.4	ZERO %
2	5	10	503.4	499.8	3.6	5.56%
3	5	10	503.6	499.8	3.8	5.26%
4	5	10	503.6	499.8	3.8	0.00%

$$\Delta W = \frac{(W_{(i-1)} - W_{(i)})}{W_{(i-1)}} * 100$$

Total Silt, (g) = Filter Silt + Pan Silt

Total Silt, (g) = 7.8

	No. 20 Sieve (g)	No. 200 Sieve (g)	Pan (g)
Final Weight, (g)	381	340.2	503.6
Tare Weight, (g)	382.1	304.8	499.8
Net Weight, (g)	-1.1	35.4	3.8
Wt. Fraction, %	-2.38%	76.62%	8.23%

Area Swept, m^2 189.46

Silt Loading, g/m^2 4.12E-02

Silt Fraction, % 0.204724

SAMPLE MASS COMPARISION

Dry sample weight	46.2
Sized sample weight	42.1
Net Difference	4.1

Max allowable limit is 2% difference, or for this particular sample: 0.924 gms.

Curb Silt Analysis Data Sheet

Analysis Date: 8/7/97 | Bag ID No.: D-032

Collection Location: Creedmore | Analyst: Frederici

Comments: Between Hwy 709 & Millwood

Note: Curb Area Sample

I. Moisture Analysis

Note: w.b. = wet basis, d.b. = dry basis

Balance properly zeroed and calibrated: 8/7/97 (Date)

Bag Contents		Filter Bag	
Combined Pan & Sample Weight (w.	330.0 ✓	Bag & Pouch Tare Weight, g	92.5
Weighing Pan Tare Weight, g	211.2 ✓	Bag, Pouch & Sample Wt, (w.b.), g	211.6
Sample Weight (w.b.), g	118.8	Bag, Pouch & Silt Wt., brushed (w.b.), g	85.8
Combined Pan & Sample Weight (d.	329.5	Silt Weight, (w.b.), g	-6.7
Sample Weight (d.b.), g	118.3	Dried Bag, Pouch & Silt Wt. (d.b.), g	97.5
[redacted] W_i		Silt Weight, (d.b.), g	5
W_f			

125.7

Percent Moisture Content % -9.99%

$$\%M = \frac{W_i - W_f}{W_i} * 100$$

II. Particle Sizing Analysis and Silt Loading

Shaker Run Number	Elapsed Time (min)	Collection Pan, Silt Weight, (%)	Pan Tare Weight	Pan Net	Change in Silt Weight, (%)
1 5	10	508.3	499.8	8.5	ZERO %
2 5	10	508.6	499.8	8.8	3.41%
3 5	10	508.9	499.8	9.1	3.30%
4 5	10	509	499.8	9.2	1.09%

$$\Delta W = \frac{(W_{(i-1)} - W_{(i)})}{W_{(i-1)}} * 100$$

Total Silt, (g) = Filter Silt + Pan Silt

Total Silt, (g) = 14.2

	No. 20 Sieve (g)	No. 200 Sieve (g)	Pan (g)
Final Weight, (g)	424.3	365.4	509
Tare Weight, (g)	382.2	304.8	499.8
Net Weight, (g)	42.1	60.6	9.2
Wt. Fraction, %	34.14%	49.15%	7.46%

Area Swept, m^2 23.81

Silt Loading, g/m^2 5.96E-01

Silt Fraction, % 0.18984

SAMPLE MASS COMPARISION

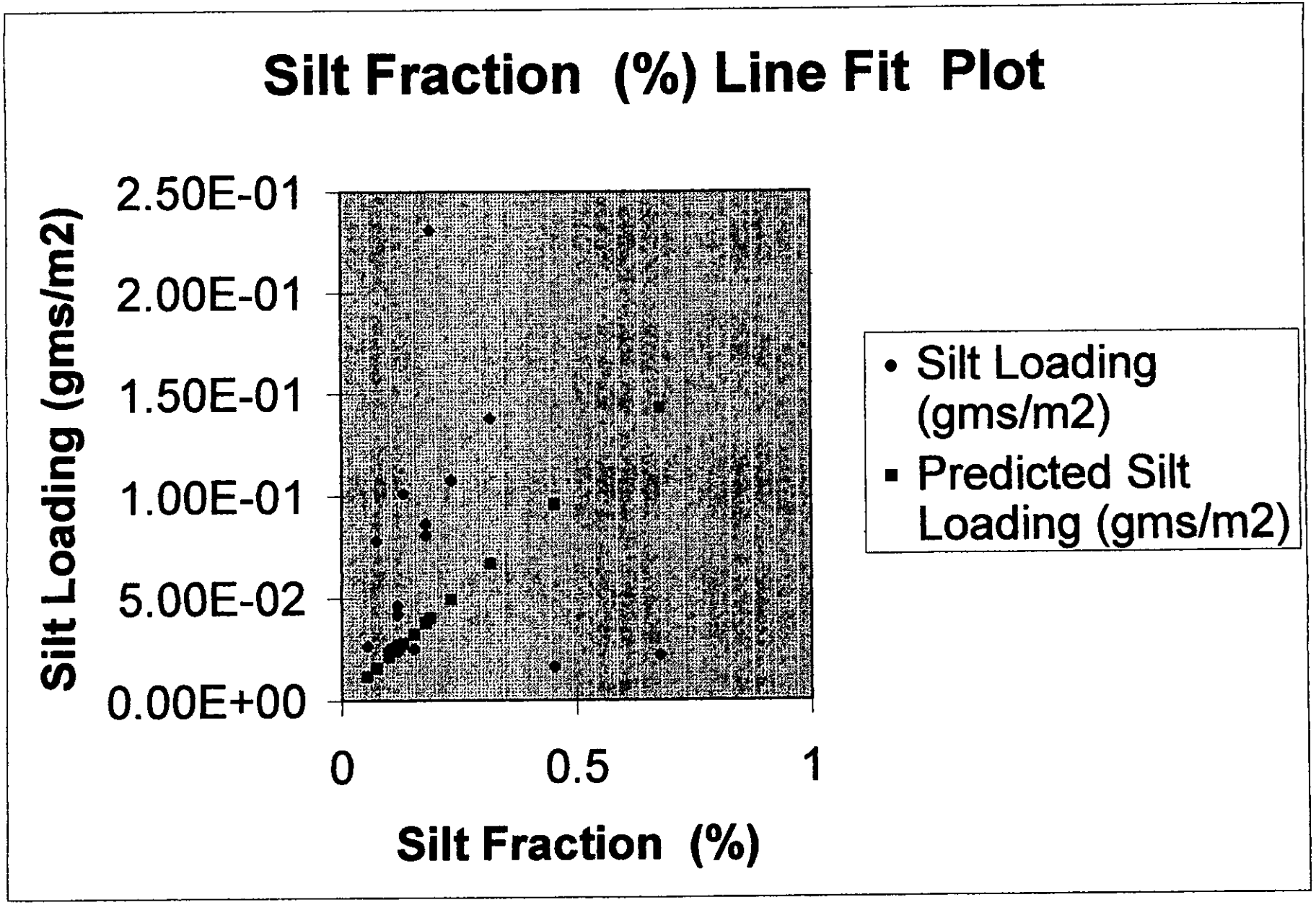
Dry sample weight	123.3
Sized sample weight	116.9
Net Difference	6.4

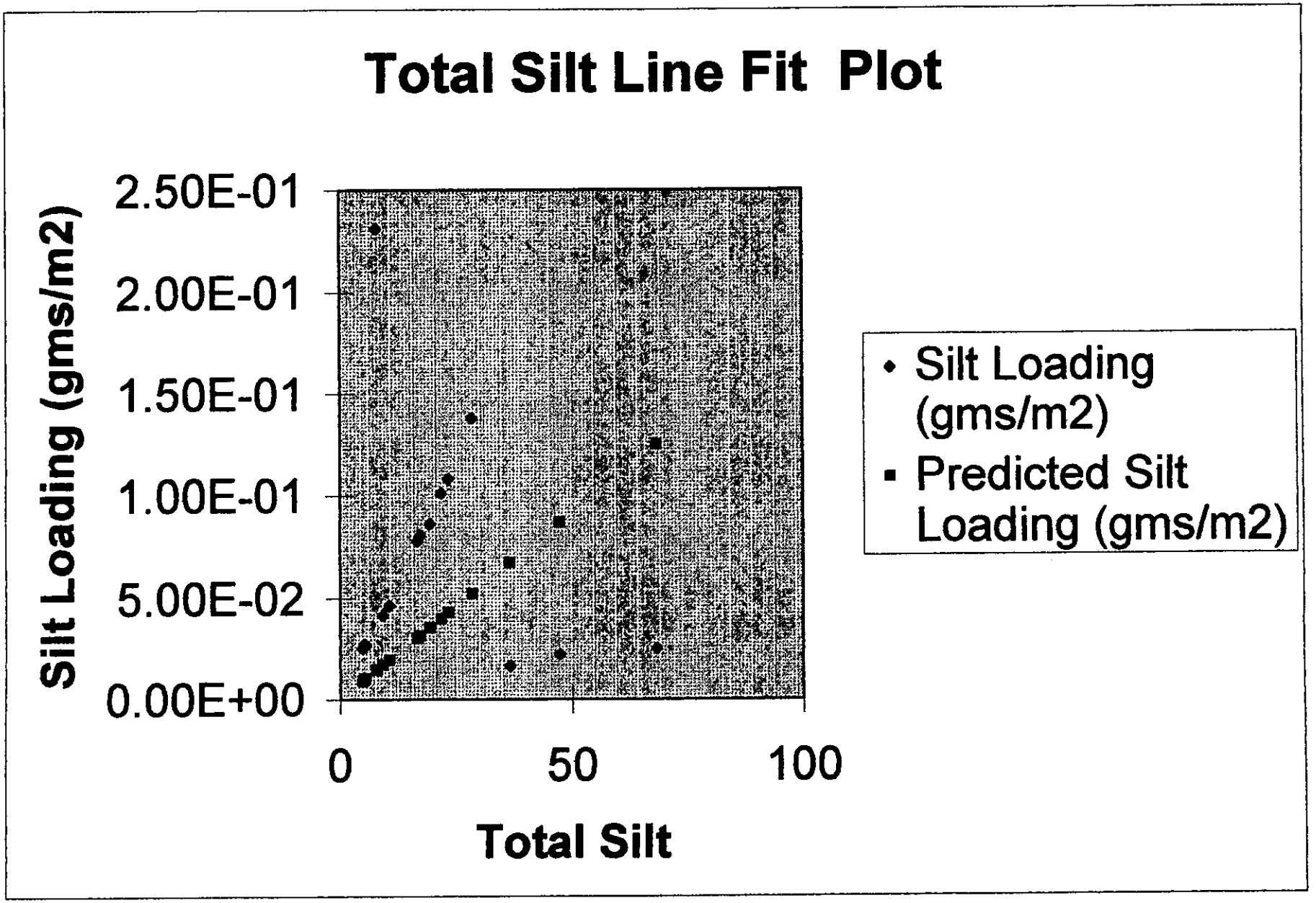
Max allowable limit is 2% difference, or for this particular sample: 2.466 gms.

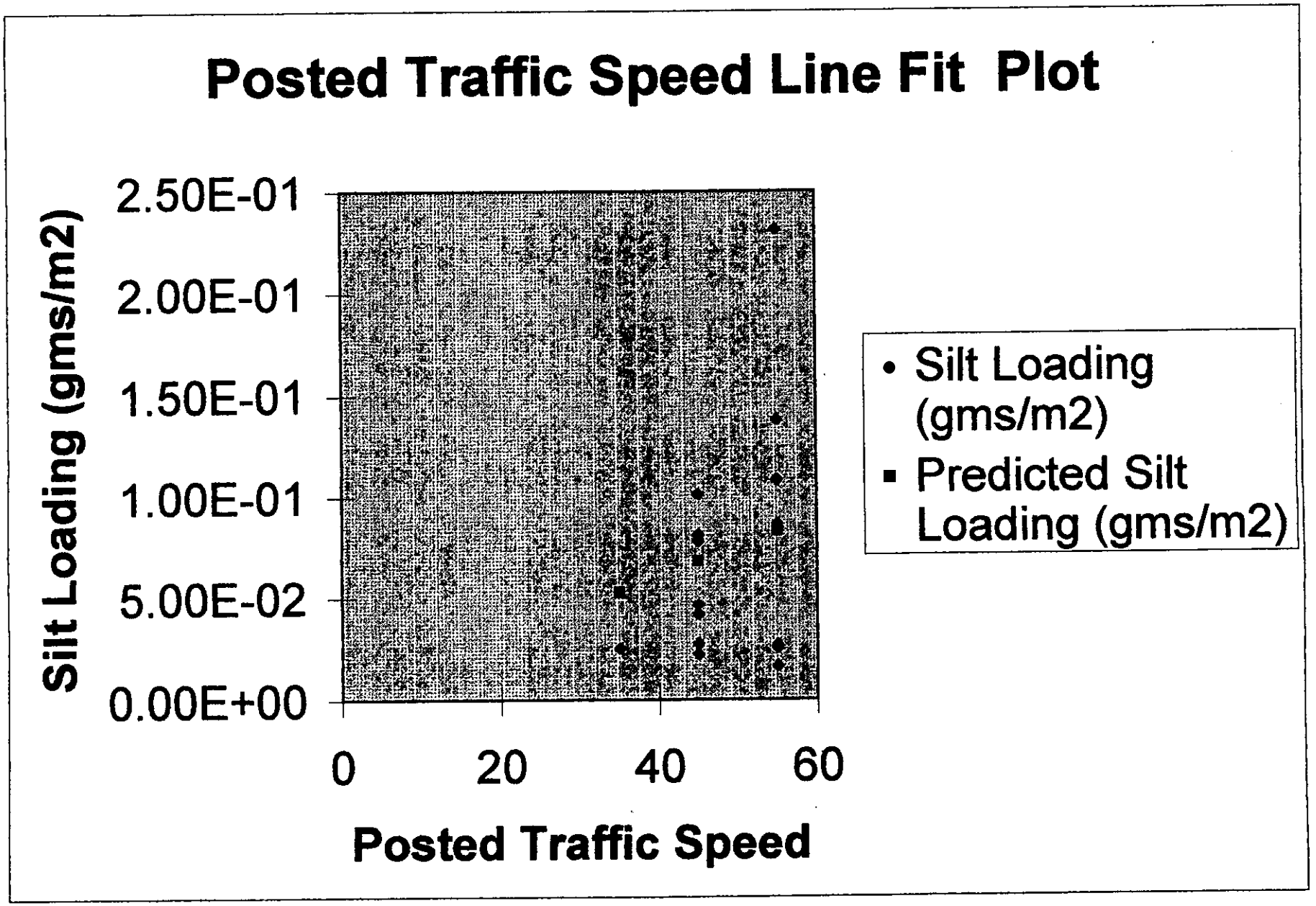
APPENDIX J

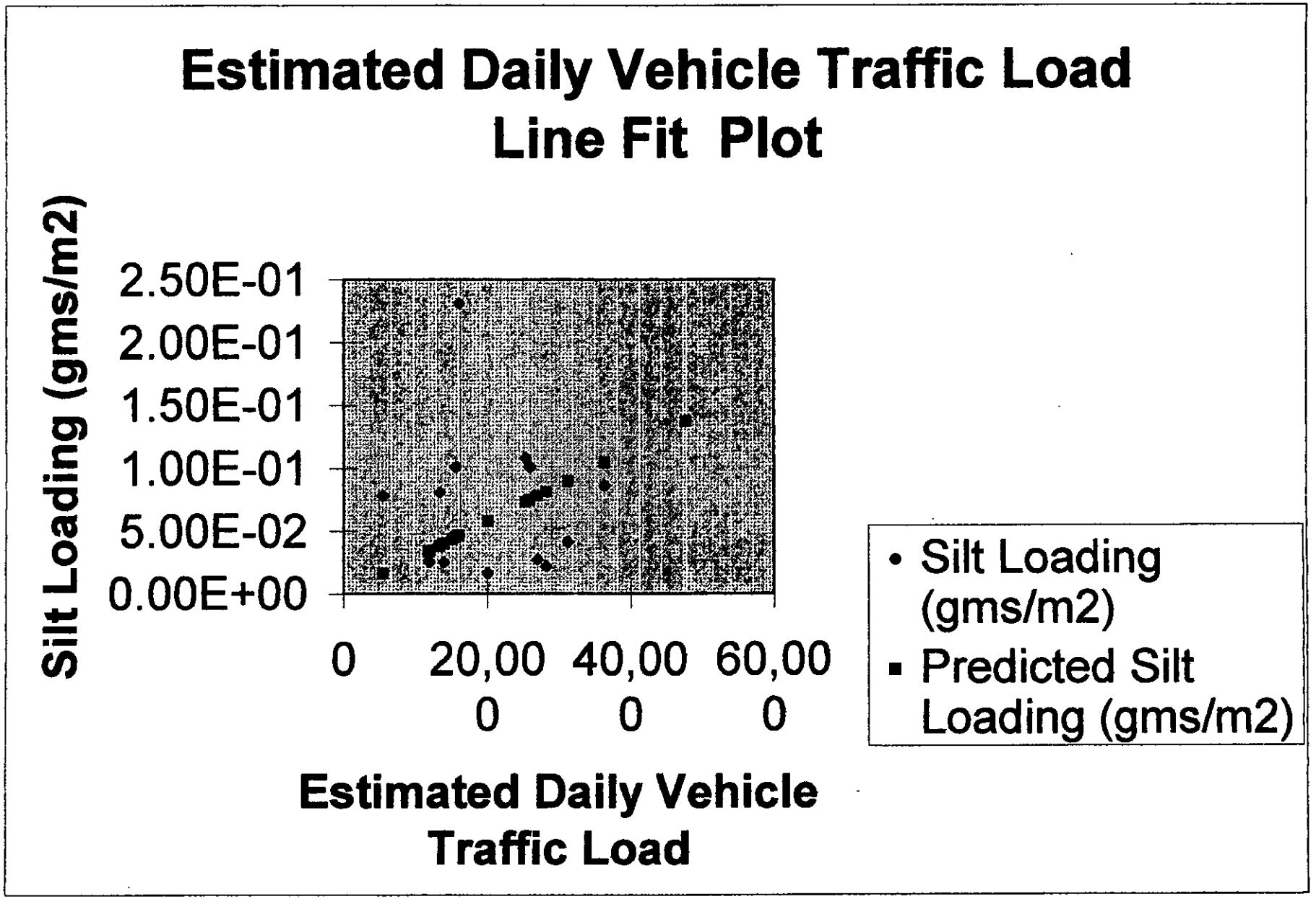
Regression Analysis Line Plots of
Dependent and Independent Variables

The following four pages are regression line plots of road silt samples collected by PES.

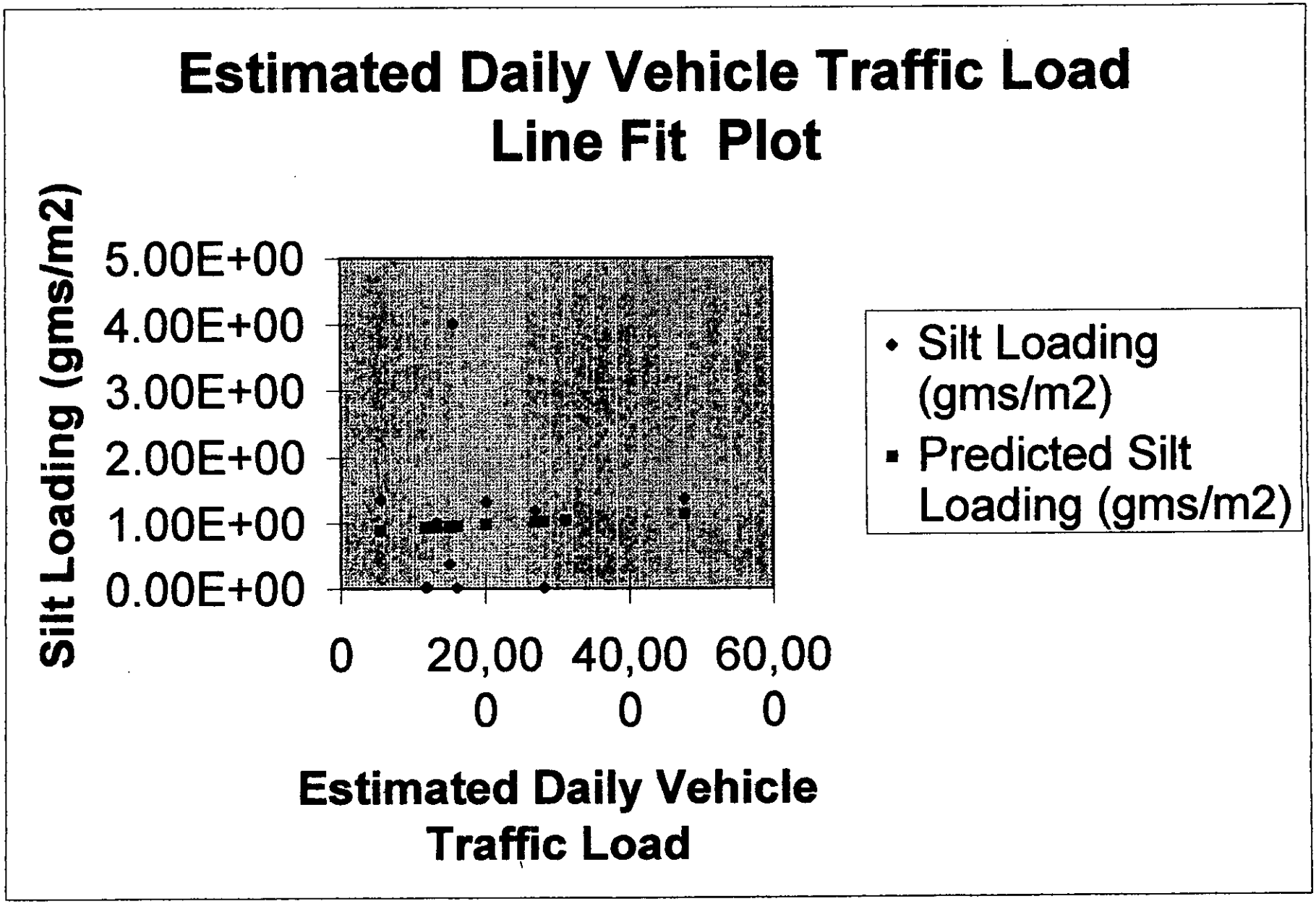

Silt Fraction (%) Line Fit Plot
Silt Loading (gms/m2)
2.50E-01
2.00E-01
1.50E-01
1.00E-01
5.00E-02
0.00E+00
0
0.5
1
Silt Fraction (%)
Silt Loading (gms/m2)
Predicted Silt Loading (gms/m2)

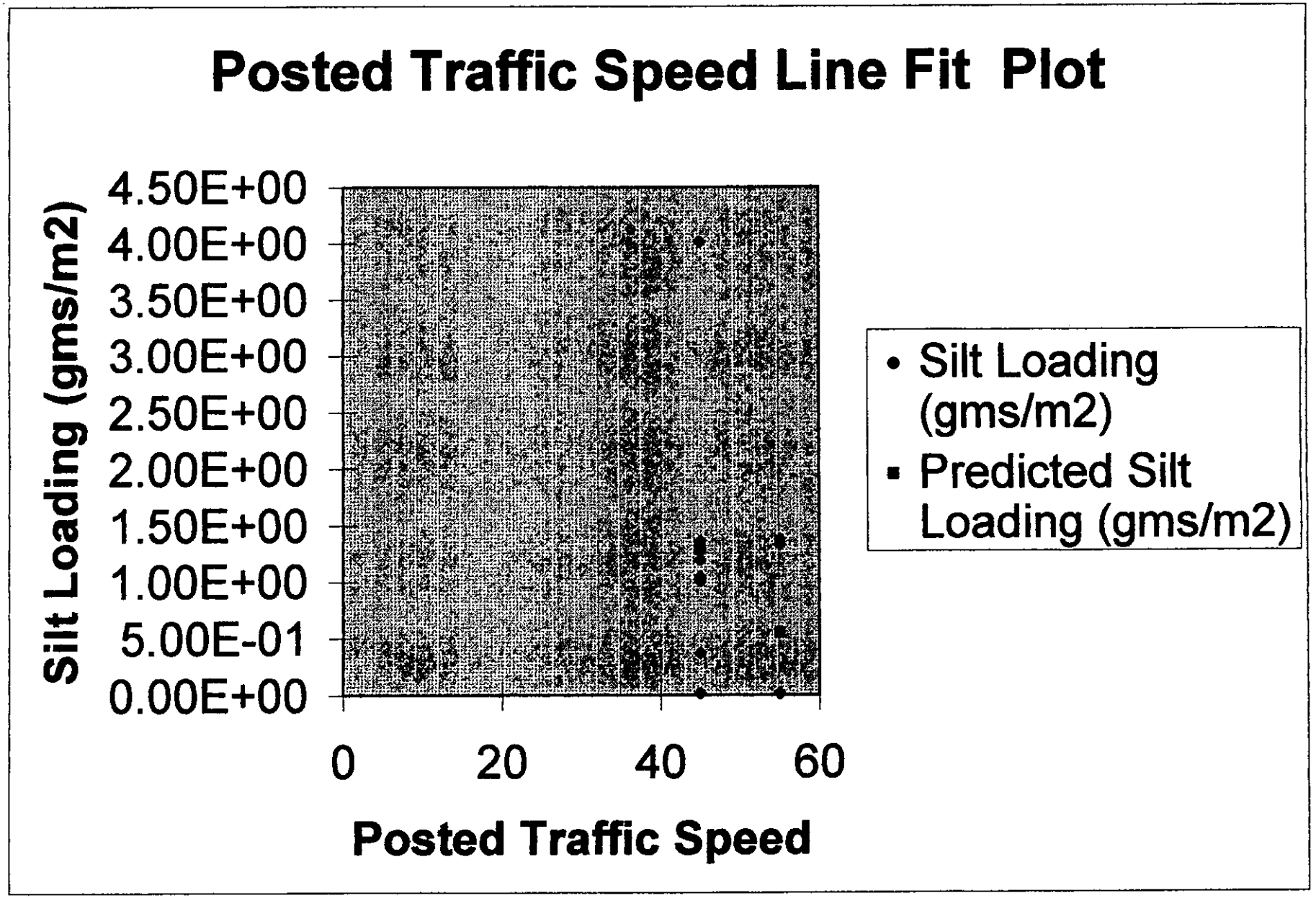

Total Silt Line Fit Plot
Silt Loading (gms/m2)
2.50E-01
2.00E-01
1.50E-01
1.00E-01
5.00E-02
0.00E+00
0
50
100
Total Silt
Silt Loading (gms/m2)
Predicted Silt Loading (gms/m2)

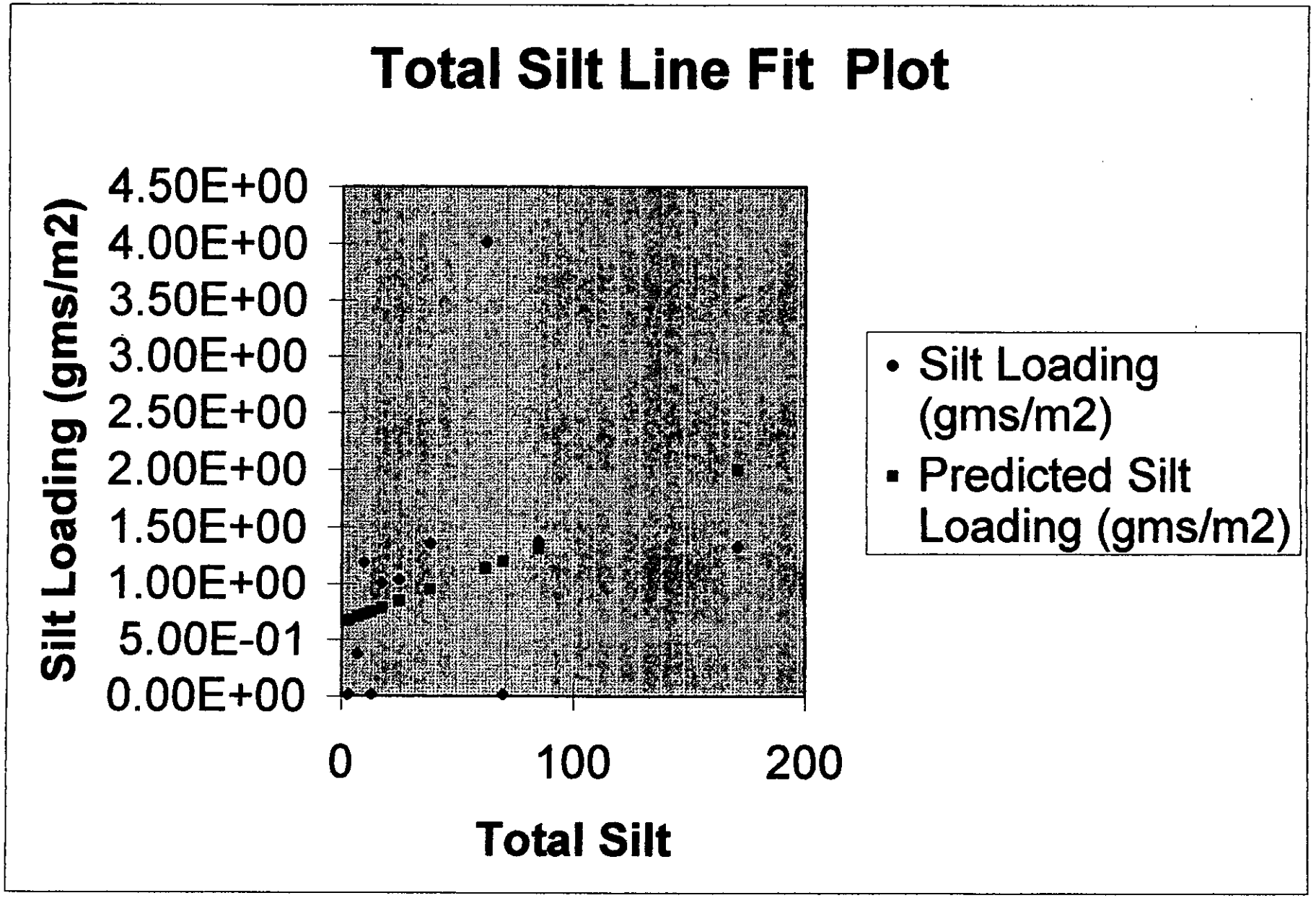

Posted Traffic Speed Line Fit Plot
Silt Loading (gms/m2)
2.50E-01
2.00E-01
1.50E-01
1.00E-01
5.00E-02
0.00E+00
0
20
40
60
Posted Traffic Speed
Silt Loading (gms/m2)
Predicted Silt Loading (gms/m2)

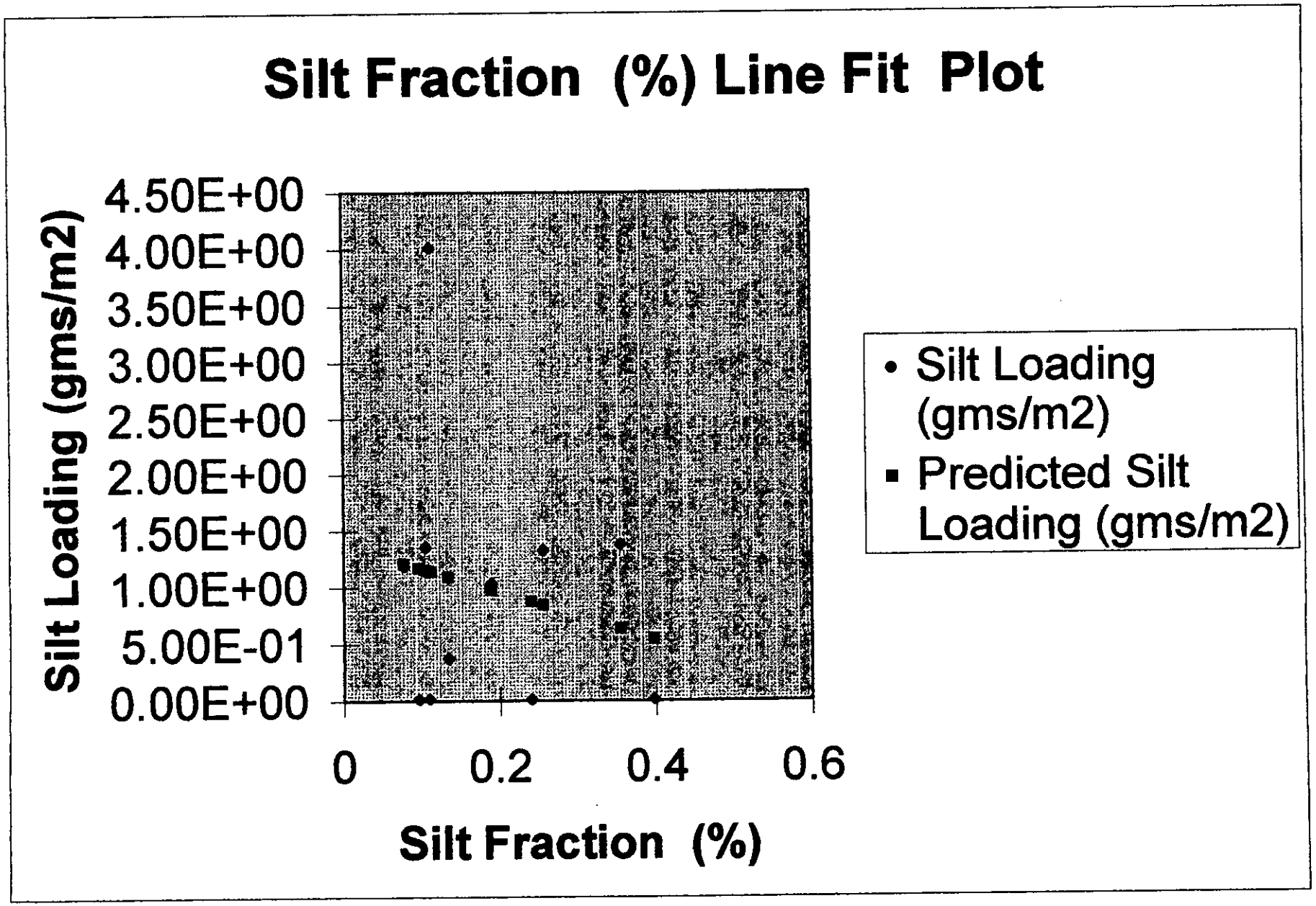

Estimated Daily Vehicle Traffic Load
Line Fit Plot
Silt Loading (gms/m2)
2.50E-01
2.00E-01
1.50E-01
1.00E-01
5.00E-02
0.00E+00
0
20,000
40,000
60,000
Estimated Daily Vehicle Traffic Load
Silt Loading (gms/m2)
Predicted Silt Loading (gms/m2)

The following four pages are regression line plots of curb silt samples collected by PES.


Estimated Daily Vehicle Traffic Load
Line Fit Plot
Silt Loading (gms/m2)
5.00E+00
4.00E+00
3.00E+00
2.00E+00
1.00E+00
0.00E+00
0
20,000
40,000
60,000
Estimated Daily Vehicle Traffic Load
Silt Loading (gms/m2)
Predicted Silt Loading (gms/m2)


Posted Traffic Speed Line Fit Plot
Silt Loading (gms/m2)
4.50E+00
4.00E+00
3.50E+00
3.00E+00
2.50E+00
2.00E+00
1.50E+00
1.00E+00
5.00E-01
0.00E+00
0
20
40
60
Posted Traffic Speed
Silt Loading (gms/m2)
Predicted Silt Loading (gms/m2)


Total Silt Line Fit Plot
Silt Loading (gms/m2)
4.50E+00
4.00E+00
3.50E+00
3.00E+00
2.50E+00
2.00E+00
1.50E+00
1.00E+00
5.00E-01
0.00E+00
0
100
200
Total Silt
Silt Loading (gms/m2)
Predicted Silt Loading (gms/m2)


Silt Fraction (%) Line Fit Plot
Silt Loading (gms/m2)
4.50E+00
4.00E+00
3.50E+00
3.00E+00
2.50E+00
2.00E+00
1.50E+00
1.00E+00
5.00E-01
0.00E+00
0
0.2
0.4
0.6
Silt Fraction (%)
Silt Loading (gms/m2)
Predicted Silt Loading (gms/m2)